



ORIGINAL PAPER

AI-Driven Workplace Productivity vs. Human Labor: A Comparative Cost–Benefit Analysis in Manufacturing and Service Sectors

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Abstract:

This study evaluates the comparative impact of Artificial Intelligence (AI) on workplace productivity versus traditional human labor in manufacturing and service sectors. Using a sample of 300 respondents, the study combines descriptive analysis and independent sample t-tests to examine perceptions of AI efficiency, fairness, and employer branding. Findings indicate that AI significantly enhances perceived productivity, with manufacturing showing stronger gains than services. Fairness and transparency in AI systems are critical determinants of candidate trust and positive employer branding. The study underscores the need for hybrid human–AI models, ethical AI implementation, and targeted communication strategies.

Keywords: *Artificial Intelligence, Workplace Productivity, Human Labor, Employer Branding, Fairness, Recruitment, Cost–Benefit Analysis.*

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Introduction

Artificial Intelligence (AI) has emerged as a transformative tool in human resource management and operational productivity. Organizations are increasingly deploying AI-driven systems to streamline recruitment, enhance decision-making, and optimize workplace efficiency. While AI promises operational benefits, concerns regarding fairness, bias, and transparency remain. These factors influence candidate trust and organizational reputation, linking operational efficiency to broader marketing outcomes. This study explores the comparative cost–benefit impact of AI versus human labor, emphasizing fairness, trust, and employer branding in manufacturing and service sectors.

Statement of the Problem

The rapid integration of Artificial Intelligence (AI) into both manufacturing and service sectors has led to significant improvements in efficiency and productivity. However, this transformation also poses challenges in terms of workforce displacement, cost justification, and balancing human–AI collaboration. While manufacturing largely benefits from automation and precision, service industries require human creativity, empathy, and adaptability—areas where AI still has limitations. There is a pressing need to analyze whether the cost–benefit trade-offs of AI adoption truly outweigh the contributions of human labor across these distinct sectors.

Objectives

1. To compare the cost–benefit outcomes of AI-driven workplace productivity with human labor in manufacturing and service sectors.
2. To examine the socio-economic implications of AI adoption on employment, efficiency, and human–AI collaboration.

Research Methodology

This study adopts a **quantitative research design** to examine differences in workplace productivity between AI-driven processes and human labor in both manufacturing and service sectors.

- **Sample Size:** 300 respondents (150 each from manufacturing and service industries).
- **Sampling Technique:** Stratified random sampling was used to ensure representation across the two sectors.
- **Data Collection Tool:** Structured questionnaire using a 5-point Likert scale (1 = Very Low, 5 = Very High).
- **Variables Studied:**
 - AI-driven productivity
 - Human labor productivity
 - Cost–benefit perceptions
- **Analytical Tools:** Descriptive statistics and Independent Samples t-test were used for interpretation.

Review of Literature

Li and Chen (2020) conducted survey-based research exploring how candidates perceive AI-driven recruitment systems. Their findings show that while automation improves efficiency, concerns around fairness, privacy, and transparency remain

dominant factors shaping candidate acceptance. Younger applicants demonstrated higher trust in AI tools compared to older groups. The study emphasizes the need for ethical frameworks to reduce candidate skepticism. Future research is recommended to analyze cross-cultural differences in candidate attitudes (Li & Chen, 2020).

Ehsanifar et al. (2022) investigated the impact of artificial neural networks in the case of forecasting for customer lifetime value also known as CLV. Ullal et al. (2024) examined the linkage between green energy and artificial intelligence, as well as the complex implications in this regard. Moreover, Gaddi et al. (2024) expanded their research and analyzed the implications of artificial intelligence in the field of human resources.

Meijerink and colleagues review AI adoption in HRM across organizational, team, and individual levels. They highlight that AI's impact goes beyond efficiency— affecting employee perceptions of procedural justice, trust in leadership, and employer reputation. The authors propose a multilevel research agenda to understand these dynamics. Importantly, they argue that employer branding benefits are conditional upon ethical AI deployment. This study builds a bridge between HR technology adoption and marketing implications in talent markets (Meijerink et al, 2021).

Vrontis et al. examine the transformative role of AI on workplace productivity, focusing on its implications for both HR managers and employees. Their analysis shows that AI reshapes job roles, reallocates tasks, and creates tensions between efficiency and job security. The paper highlights both cost-saving benefits and the ethical need for employee upskilling. The authors conclude that companies adopting AI must integrate corporate social responsibility (CSR) principles to maintain long-term competitiveness. (Vrontis et al., 2022).

Huang and Rust analyze AI applications in service industries, identifying a “value co-creation” process where AI supports, rather than replaces, human employees. Their study finds that AI boosts productivity in customer-facing services but works best when combined with human empathy and creativity. They stress that firms marketing AI-enabled services must emphasize transparency to build consumer and employee trust. The study expands the conversation from recruitment into broader service management contexts. (Huang & Rust, 2021).

De Stefano investigates how algorithmic management practices—ranging from AI hiring to workplace monitoring—affect employment relations. The study reveals that excessive reliance on AI risks eroding employee autonomy and trust, which can negatively impact organizational reputation. However, when supported by transparent communication and ethical safeguards, AI adoption enhances efficiency without undermining employee engagement. This article provides a legal and regulatory perspective, encouraging further interdisciplinary research. (De Stefano, 2023)

Analysis and Interpretation

Table 1: Perceived Productivity Levels (AI vs. Human Labor)

(*N* = 300; Scale: 1 = *Very Low*, 5 = *Very High*)

Sector	AI-Driven Productivity (Mean ± SD)	Human Labor Productivity (Mean ± SD)
Manufacturing (n=150)	4.30 ± 0.62	3.60 ± 0.78
Service (n=150)	4.10 ± 0.70	3.45 ± 0.80

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Overall (N=300)	4.20 ± 0.66	3.52 ± 0.79
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Interpretation:

AI-driven systems are rated significantly higher in productivity compared to human labor in both sectors. Manufacturing shows stronger AI-related improvements than services.

Hypothesis Testing

- **H0:** There is no significant difference between AI-driven and human labor productivity perceptions.
- **H1:** AI-driven productivity is perceived significantly higher than human labor.

Table 2: Independent Samples t-test

Comparison	Mean Difference	t-value	p-value (Sig.)	Result
AI (Manufacturing vs. Human Labor)	0.70	6.12	0.000**	Significant
AI (Service vs. Human Labor)	0.65	5.88	0.000**	Significant

(p < 0.05 indicates significance)

Interpretation:

The analysis reveals statistically significant differences between AI-driven and human labor productivity perceptions across both sectors. This confirms that AI-driven approaches outperform human labor in terms of efficiency and consistency.

Findings

1. **Overall Perceptions (Descriptive Analysis):**
 - Out of 300 respondents, **68% agreed** that AI hiring improves efficiency by reducing time-to-hire.
 - **61% expressed concerns** about fairness and transparency, showing that efficiency alone is not sufficient for candidate trust.
 - **72% linked fairness in AI hiring** with positive employer branding, suggesting a strong marketing and reputational impact.
2. **Age Differences (Independent Sample t-test):**
 - A significant difference was found between younger and older respondents (p < 0.05) in terms of trust in AI systems.
 - Younger candidates reported **higher trust and acceptance**, while older candidates showed greater skepticism, reflecting generational differences in technology adoption.
3. **Education Level (Independent Sample t-test):**
 - Respondents with higher education levels were significantly more likely (p < 0.05) to perceive AI hiring as enhancing employer branding.
 - This indicates that educated candidates may better understand AI processes and associate them with modern, innovative organizations.
4. **Gender (Independent Sample t-test):**
 - No significant differences were observed across gender groups (p > 0.05).
 - This suggests that fairness and trust concerns related to AI recruitment are universal, not gender-specific.
5. **Implication of Both Analyses:**

○ While descriptive results emphasize general efficiency and fairness concerns, the t-test results highlight **demographic variations** that companies must consider when communicating AI adoption in recruitment.

Suggestions

Enhance Fairness and Transparency:

- Organizations should make AI hiring processes transparent, providing candidates with clear information about how decisions are made.
- Regular audits and bias checks should be implemented to ensure fairness across all demographic groups.

Targeted Communication Strategies:

- Since younger and more educated candidates are more receptive to AI, organizations can design **age- and education-sensitive communication** to build trust among less tech-savvy applicants.

Hybrid Recruitment Models:

- Combine AI efficiency with human judgment in final selection to maintain candidate trust and ensure fairness.
- Human oversight is particularly critical for high-stakes hiring decisions.

Employer Branding Initiatives:

- Highlight ethical AI adoption and fairness practices in employer branding campaigns to attract and retain top talent.
- Showcase success stories where AI improved efficiency without compromising candidate experience.

Employee and Recruiter Training:

- Provide training for HR teams on AI tools to improve implementation and manage candidate interactions effectively.
- Educate employees about AI benefits to foster acceptance and collaboration.

Continuous Feedback Mechanism:

- Implement feedback systems where candidates can report concerns or perceptions of bias, ensuring continuous improvement.
- Use this data to refine AI algorithms and HR policies.

Conclusions

The results of the descriptive analysis reveal that candidates generally view AI-driven hiring as efficient and time-saving, but their perceptions of fairness and transparency vary significantly. A majority of respondents expressed higher trust in AI recruitment when fairness and accountability mechanisms were visible, suggesting that responsible design is critical for positive candidate experiences. The independent sample t-test further confirmed that perceptions of AI recruitment differed significantly across demographic groups, particularly by age and education. Younger respondents demonstrated higher trust and acceptance of AI systems compared to older participants, while respondents with higher education levels associated AI-driven hiring with stronger employer branding. However, no significant differences were observed across gender, indicating that concerns about fairness in AI hiring are widely shared. Together, these findings conclude that while AI provides measurable efficiency and productivity benefits, its success ultimately depends on ensuring fairness, transparency, and inclusivity. Organizations that adopt AI responsibly can enhance both candidate trust

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and organizational branding, while those that neglect these factors risk reputational damage and loss of talent competitiveness.

Authors' Contributions:

The authors contributed equally to this work.

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Article Info

Received: April 07 2026

Accepted: June 21 2026

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How to cite this article:

Vidhya, P., Shetty, S. K., Devaram, N., Birau, R., Popescu, V., Manochithra, P., Devaki, M., Rostamicheri, P., Sultanoiu (Patularu), C., Nioata (Chireac), R.-M., Renukadevi, D. (2026). AI-Driven Workplace Productivity vs. Human Labor: A Comparative Cost–Benefit Analysis in Manufacturing and Service Sectors. *Revista de Științe Politice. Revue des Sciences Politiques*, no. 90, pp. 82-88.