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A REVIEW OF THE IMPACT OF ARTIFICIAL INTELLIGENCE ADOPTION ON EMPLOYEE ENGAGEMENT IN THE PHARMACEUTICAL SECTOR OF KHYBER PAKHTUNKHWA

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Abstract

Industries are rapidly being transformed by the advent of Artificial Intelligence (AI) and the pharmaceutical industry is no exception. The review discusses the changes in employee engagement with the introduction of AI, in the pharmaceutical industry of Khyber Pakhtunkhwa (KP) in Pakistan. The paper reviews the literature and theories such as the Job Demands Resources (JD R) model and Technology Acceptance Model (TAM) to explain the benefits and challenges of the integration of AI. The review also brings to the surface the moderating effect of technological self-efficacy and mediating role of organisational support. Suggestions for ethical and employee friendly AI implementation are also presented.

1. Introduction

Artificial Intelligence (AI) is being used in the organizations to change the traditional systems and processes in the workplace across all sectors. Machine learning, natural language processing (NLP), and robotic process automation (RPA) are some forms of AI that try to replicate or enhance human

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intelligence (Brynjolfsson and McAfee, 2014; Jarrahi, 2018). These are not technological innovations but they are transformative technologies that can aid in faster decision making, reduce human error and improve the efficiency of the organisations.

One of the markets where AI is suitable is in the pharmaceutical market as it is an industry that needs accuracy, compliance and data-driven decision making. AI is beginning to be more widely used in drug discovery, clinical trial simulations, quality assurance and supply chain management in Pakistan, especially in Khyber Pakhtunkhwa (KP) (Topol, 2019; Shoukat et al., 2023). Such uses are poised to change how pharmaceutical firms operate and this will make them more efficient and competitive. However, the human side of the introduction of AI, especially the effect on employee engagement, is often overlooked, even in developing nations. Employee engagement as defined by Kahn (2013) is the level of energy, commitment and involvement an individual has in their role. It is a significant predictor of performance, innovation, job satisfaction and turnover (Saks, 2015). While AI can have a positive impact on engagement by reducing routine tasks and allowing employees to engage in knowledge work it may also create fear, anxiety and resistance when not implemented carefully (Frey and Osborne 2017; Brougham and Haar, 2018).

AI is being introduced in KP's pharmaceutical industry without concurrently improving digital skills, psychological resilience and employee support which raises questions on the impact this may have on the engagement levels of employees (Kazmi et al., 2024). The aim of the review is to look into the literature regarding AI and engagement and the influence of organisational support and technology self efficacy on this relationship.

To study these complex processes, two already existing theoretical models are used:

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- The Technology Acceptance Model (TAM) explains the impact of perceived usefulness and ease of use of new technologies on the acceptance of the new technologies by the employees (Davis, 1989).
- The Job Demands Resources (JD R) model is based on the assumption that job demands (e.g., stress, cognitive overload) may result in disengagement, and job resources (e.g., support, autonomy) may increase motivation and engagement (Demerouti et al., 2001).

With adequate support for the implementation of AI, it can be a motivating resource. Without support, AI can, on the other hand, be a demand and lead to disengagement. Further, Perceived Organizational Support (POS) is a mediator as it helps to enhance the perception of employees that the organisation values them (Rhoades and Eisenberger, 2002) and Technological Self Efficacy (TSE) is a moderator as this impacts the trust of employees in AI (Compeau and Higgins, 1995). While AI is becoming more common in the pharmaceutical industry of KP, very little has been done with the human centric implications of AI. This review fills this gap, by examining the findings of the fascinating literature to give an insight on how companies can align technological transformation in sustainable human capital development.

2. Literature Review

This article will examine the effects of AI on employee engagement, as discussed in three studies. The digital age is transforming employee engagement. Engagement is the emotional, cognitive and behavioural attachment of employees to their work, is now being impacted by rapid technological advancements such as the adoption of AI (Saks, 2015). While the use of AI systems simplifies the work and helps increase productivity, they also undermine the traditional employment arrangements and skill sets (Kazmi et al., 2024). The ambivalence of the impact of AI in the workplace has raised concerns for job loss and emotional disengagement (Frey and Osborne,

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2017). This is further exacerbated in emerging markets such as Khyber Pakhtunkhwa due to limited support and low digital literacy, and absence of policy guidance. Given the pharmaceutical industry in KP is beginning to implement AI in their workplaces, it is essential to understand the psychological and practical effects of AI on employee engagement (Shoukat et al., 2023).

2.2 The beneficial effects of AI on Engagement.

With careful planning and support of involving employees, the adoption of AI has shown the potential to increase engagement with a greater impact. AI has been proven to eliminate repetitive work and allow the employees the opportunity to focus on more value adding tasks that can lead to innovation and growth (Vrontis et al., 2022). Similarly, AI enabled technologies can empower employees with real time analytics, decision making and collaboration technologies (Topol, 2019). This is true for the pharmaceutical industry as well where AI systems are helping to optimise production, ensure data integrity and accelerate drug discovery processes. These improvements will make these jobs more satisfying and pleasant (Zaman et al., 2025). A boost in engagement is likely to be triggered by the tangible outcomes of AI driven decision improvements and organisational success. There is recent research that suggests training, transparency and employee participation in implementation of AI leads to improved job satisfaction, autonomy and purpose (Sharma and Lal, 2020).

2.3 Negative Impacts and Concerns

Despite the benefits, AI implementation comes with several risks. The immediate concern is the fear of job redundancy - especially in routine jobs. Frey and Osborne (2017) report that automation may have a greater impact on workers in predictable environments and this is one of the characteristics of pharmaceutical lines. Brougham and Haar (2018) found that AI and robotics

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are regarded as a threat to jobs and career development. This fear is magnified in the areas like KP where there are no retraining opportunities and support from the employers. In Sajjad et al. (2025), the psychological stress due to the use of AI: confusion and stress, and the loss of control, often led to disengagement and turnover intentions. Further, Huang and Rust (2021) note that when AI is used in surveillance and in performance monitoring, there will be a lack of trust between employees and the management, which will adversely affect morale and productivity.

2.4 Theoretical Perspectives

Between 2015 and 2025, a group of contemporary variations of the original models has been applied to study the effects of adopting AI on employee engagement:

a. Updated Technology Acceptance Models. Today's version of the Technology Acceptance Model (TAM) includes the role of user experience, ease of use, and perceived strategic fit; these are the factors that affect employee adoption (Davenport et al., 2020). Sharma and Lal (2020) confirm that the greater belief of employees in the user friendliness and benefits of AI, the greater will be its acceptance.

b. Job Demands Resources (JD R) in AI The recent use cases of the JD R model in the context of AI suggest that the job demands such as mental strain and transition anxiety rise during the stages of AI implementation and the resources to mitigate demands such as training, feedback and support from managers become critical (Vrontis et al., 2022; Kazmi et al., 2024). There will be a greater probability of employees remaining engaged in a situation of resources and demands abundance. c. Emerging Constructs (2015–2025)

● Perceived Organizational Support (POS) is also being substantiated in the context of AI. Zaman et al. (2025) report employees supported through change are more motivated, trusting and change ready.

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- Technological Self Efficacy (TSE) has been found to mediate the link between adoption and engagement of AI. Staff with high TSE view AI as a promise but not a threat, which has positive outcomes of engagement (Sharma and Lal, 2020; Kazmi et al., 2024).

3. Major Variables and Conceptual Framework.

This review proposes four key variables to examine how the use of AI impacts employee engagement, drawing from the Technology Acceptance Model (TAM), the Job Demands Resources (JD R) model and other empirical studies in the years 2015 2025. These are the basis for the conceptual model.

3.1 Key Variables

Variable Type Construct Definition

Independent AI Adoption The degree to which AI technologies are adopted and used in performing job tasks. Zaman et al., 2025; Shoukat et al., 2023

Dependent Employee Engagement Emotional, cognitive and behavioural commitment of employees to their jobs and organisations. Saks, 2015; Sharma & Lal, 2020

Mediator Perceived Organizational Support (POS) The degree to which the employees feel that their organization values them and their efforts. Zaman et al., 2025; Sajjad et al., 2025

Moderator Technological Self Efficacy (TSE) Employees' self belief in their ability to use AI technologies. Kazmi et al., 2024; Sharma & Lal, 2020

3.2 Explanation of Relationships

AI Adoption (Independent Variable) The use of AI technologies such as machine learning, natural language processing, and robotic automation in business processes is known as AI adoption. This could involve AI for predictive analytics, supply chain management or automatic drug test procedures in pharmaceutical companies (Topol, 2019; Shoukat et al., 2023). Its impact on job structures is critical in reshaping the employee experience.

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Study	AI Adoption Rate	Mean Employee Engagement Score	% Citing High POS	
Kazmi et al. (2024)	52%	3.7 / 5	65%	42%
Zaman et al. (2025)	61%	3.9 / 5	72%	48%
Sajjad et al. (2025)	58%	3.8 / 5	68%	46%
Average (Across Studies)	57%	3.8 / 5	68.30%	45.30%

Employee Engagement (Dependent Variable)

Engagement is a multi-dimensional construct of vigor, dedication and absorption (Sharma & Lal, 2020). Engagement is dependent on the perceived positive or negative change in the organisation with the introduction of AI. Positive engagement leads to increased performance, creativity and retention of employees (Saks, 2015).

Perceived Organizational Support (Mediator)

Perceived Organizational Support (POS) plays a key role in employee acceptance of AI. Organizational support is essential in helping employees accept technological changes by making them feel the organisation cares about them, is rewarding them fairly and is providing them with resources such as training and mentoring (Zaman et al., 2025). POS is the link between the introduction of AI and engagement by converting resistance into adaptation.

For instance, if two firms adopt the same AI system but one firm offers in-depth training, feedback and therapy to its employees, only this firm will experience positive engagement.

Technological Self Efficacy (Moderator)

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Technological Self Efficacy (TSE) represents an employee's confidence in using AI technology. High TSE employees are likely to feel less stressed and more enthusiastic about the introduction of AI, thus reinforcing the AI engagement link (Kazmi et al., 2024).

Moderating Effect:

AI tool may increase engagement of high TSE employees but have negative impact on low TSE employees without training

3.3 Interaction of Variables in the Conceptual Framework

Pathway	Description
AI Adoption → Employee Engagement	Direct influence, where AI can either enhance or undermine engagement depending on implementation quality.
AI Adoption → POS → Employee Engagement	POS is a moderator, translating potentially stressful change into an opportunity for engagement.
AI Adoption x TSE → Employee Engagement	TSE plays a moderating role - the benefits of AI are stronger for those with higher TSE.

3.4 Regression and Correlation Findings

Relationship	Correlation Coefficient (r)	
AI Adoption ↔ Employee Engagement	0.41	$p < 0.01$
POS ↔ Employee Engagement	0.53	$p < 0.001$
TSE × AI ↔ Engagement (moderated interaction)	0.33	$p < 0.05$

Interpretation of Values

● Positive associations between AI and engagement suggest that AI can be used as a motivational tool, if employed strategically.

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- POS has the highest link, serving as a key moderator, confirming the importance of human resources and managerial support during technology changes.
- TSE has strong moderating effects, implying organizations need to focus on digital skills development and trust building.

4. Research Gaps

With increasing adoption of Artificial Intelligence (AI) in the pharmaceutical industry of Pakistan, particularly in the Khyber Pakhtunkhwa (KP) province, there is a clear gap in the literature, particularly with respect to the human factors. Most research has been focused on technology effectiveness, cost effectiveness and improved efficiency, but fails to address the effect of change on the well-being, motivation and engagement of workers who are interacting with AI technologies. A study of the literature between 2015-2025 reveals that the emphasis is on economic and managerial aspects of the change, with little to no focus on the well-being, engagement and psychosocial needs of the employees (Kazmi et al., 2024; Shoukat et al., 2023). This indicates the understanding of AI adoption in the pharmaceutical sector in KP is narrow and possibly biased with a narrow focus on the human impact of digital technologies.

4.1 Detailed Summary of Key Research Gaps

Research Gap Description Implications

1. Lack of Context

Absence of localised studies on the effect of AI on workers at KP. International studies may not relevant to KP due to socio economic, cultural and technological differences. Sajjad et al., 2025; Zaman et al., 2025

2. Inadequate Attention to Psychological Mediators

(e.g., POS) Too little research on the impact on how organizational support moderates the AI engagement relationship. Couldn't explain the impact of

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trust, support and leadership on engagement. Sharma & Lal, 2020; Kazmi et al., 2024

3. Underuse of Moderating

Factors such as Technological Self Efficacy Few studies take into account individual differences in tech adaptability that affect tech use. Possibly create generic solutions without considering high risk-low tech adaptability workers. Vrontis et al., 2022; Kazmi et al., 2024

4. Short Term, Cross

Cross Sectional Data The majority of research is on the response following implementation of exposure but not long term trends. Minimizes the understanding of engagement depending on AI exposure and adaptation. Shoukat et al., 2023; Topol, 2019

5 Underrepresentation of Frontline/Non Managerial Staff Numerous studies focus on managerial staff or IT staff, yet do not take into account the personnel who may be directly affected by AI (e.g., lab assistants, clerks in the administration desk). Polls are skewed; plans might favor increased staff levels. Brougham & Haar, 2018

6. Weak Integration of Weak connection of HRM, AI Policy HR practices to engage employees. May result in ineffective adoption of AI that fosters disengagement, resistance or attrition. Kazmi et al., 2024; Sajjad et al., 2025

4.2 Analysis and Insights

● Local Relevance:

AI engagement studies are typically based on Western research. Nonetheless, KP has different infrastructure, and digital skills and occupations. In the absence of local research, conclusions made are hypothetical and not applicable in KP firms.

● Psychosocial Factors:

The technical facets of AI are also well-explored, whereas the emotional and motivational (fear of losing a job, resistance to change, or AI stress) are not as

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well-explored in KP. This compromises the building of human friendly, robust AI adoption strategies.

Forgotten Moderators and Mediators:

Organizational Support (POS) and Technological Self Efficacy (TSE) perceptions play a significant role in the comprehension of individual attitudes and behaviours towards AI. The absence of them in KP focused studies indicates that they are interested in what and not how.

● Time is of the Essence: In the absence of longitudinal research, it is difficult to determine whether the initial hype around AI leads to further involvement or burnout. This plays an important role in change management and retention.

● Representative Sampling: Since the non-managerial workers have higher chances of being displaced or their jobs restructured by the AI, they should be considered in engagement studies. Modern studies of KP lack these views. Conclusion Future research must shift from techno economic to human to make AI justifiably and sustainably implemented in the pharmaceutical industry of KP. This includes:

● Conducting empirical studies of engagement with KP.

● Using psychological factors such as POS and TSE in analysis.

● Collecting long term and diverse data to capture differences across employees. Closing the aforementioned gaps is important not only for the sake of academic research, but also to inform policy and practice in a way that considers the importance of technological development and human well-being.

5. Policy and Managerial Implications With the increasing integration of AI technologies in pharmaceuticals, the challenge for organizations in Khyber Pakhtunkhwa (KP) is to harness the power of AI to enhance productivity while ensuring that employee morale and motivation is not compromised. Studies from 2015-2025 underline the importance of human centered AI

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integration for sustainable organisational change (Vrontis et al., 2022; Kazmi et al., 2024). So, to prevent AI from alienating employees, the following policy and managerial approaches are essential:

5.1 Training and Upskilling

Perhaps the most common finding in recent research is that digital literacy reduces AI related stress - particularly among workers with low technological self efficacy (Sharma & Lal, 2020). In the KP pharmaceutical sector, many employees (e.g., manufacturing, warehouse, admin) may not have formal training or experience with AI technologies.

Policy Implications:

- Public authorities (such as KP IT Board, Ministry of Health) should offer AI literacy courses in partnership with pharma companies.
- PPP programs can provide financial support for upskilling programs including AI interfaces used in pharma (e.g., drug interaction databases, inventory management systems or patient data management). Managerial Action Points:
- Ensure compulsory training sessions as part of the AI orientation process.
- Conduct regular (monthly) workshops to keep employees up to date on the AI system.
- Establish peer mentoring programs in which tech-savvy employees train other employees. Case Insight: Zaman et al. (2025) found that firms that provide continuous AI training programs had a 22% increase in employee engagement scores, compared to others.

5.2 Supportive Organizational Culture

Company culture is critical to whether AI is seen as an opportunity for empowerment or a threat to jobs. In Pakistan workplaces, vertical systems and communication gaps exacerbate anxiety and resistance to change (Sajjad et al, 2025).

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Policy Implications:

● Add psychological safety and ethical considerations of AI into national and corporate policies.

● Promote regulatory inspections that measure not only the performance of AI but also employee perceptions and inclusion. Managerial Action Points:

● Communicate clearly how AI will impact roles, focusing on job augmentation rather than job loss.

● Apply employee surveys to monitor morale before, during and after AI implementations.

● Reward teams with adaptive leadership, creative problem solving with AI systems. For instance, when pharma middle managers openly discussed AI issues in town hall meetings, trust levels jumped by 35%, according to Kazmi et al. (2024).

5.3 Humans and AI Working Together The key to harnessing AI is to complement human abilities, not replace them. Humans excel at judgment, creativity, empathy and leadership, but AI can process data, make predictions and recognise patterns better than humans (Topol, 2019; Huang & Rust, 2021).

Policy Implications:

● Legislations could be put in place to prohibit complete automation of key jobs without human intervention.

● Incentives could be offered to employers who retain and reskill employees rather than automate their jobs. Managerial Action Points:

● Rethink job roles to emphasise a "human in the loop" approach, where employees collaborate with AI systems to achieve a common goal.

● Create work flows that emphasise humans - such as validating reports generated by AI, offering customer support based on AI recommendations, or quality control.

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● Nurture a culture of considering AI as a partner. Research Support: Sharma and Lal (2020) report that in companies that adopted collaborative AI human arrangements, the innovation increased by 27%.

References

1. Brougham, D., & Haar, J. (2018). Smart technology, artificial intelligence, robotics and algorithms (STARA): What employees think of our future workplace. Journal of Management & Organization, 24(2), 239–257.
2. Brynjolfsson, E., & McAfee, A. (2014). The second machine age: Work, progress, and prosperity in a time of brilliant technologies. W. W. Norton.

Compeau, D. R., & Higgins, C. A. (1995). Application of social cognitive theory to training for computer skills. *Information systems research*, *6*(2), 118-143.

3. Davenport, T. H., Guha, A., Grewal, D., & Bressgott, T. (2020). The future of marketing and how AI will transform it. Journal of the Academy of Marketing Science, 48(1), 2442.
4. Demerouti, E., Bakker, A. B., Nachreiner, F., & Schaufeli, W. B. (2001). The job demands-resources model of burnout. *Journal of Applied psychology*, *86*(3), 499.
5. Frey, C. B., & Osborne, M. A. (2017). The future of employment: How susceptible are jobs to computerization? Technological Forecasting and Social Change, 114, 254280.
6. Huang, M. H., & Rust, R. T. (2021). An artificial intelligence marketing strategic plan. J. of the Academy of Marketing Science, 49(1), 3050.
7. Jarrahi, M. H. (2018). The future of work and artificial intelligence: Human AI symbiosis in organizational decision making. Business Horizons, 61(4), 577–586.

Kahn, W. A., & Fellows, S. (2013). Employee engagement and meaningful work.

8. Kazmi, S. I. H., Afzal, M. F., Gondal, S., Ashraf, M. U., & Umair, M. (2024). Evaluating the impact of artificial intelligence on employee engagement and performance in Pakistan. Journal of Excellence in Social Sciences, 3(1), 3042.

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ISSN Print: 3006-2039

Volume. 5, Issue No. 2 (2026)

9. Rhoades, L., & Eisenberger, R. (2002). Perceived organizational support: a review of the literature. *Journal of applied psychology*, *87*(4), 698.
10. Sajjad, W., Inam, A., Ahmed, B., Zahir, M., Mujtaba, A., Khan, Z., Saddique, M. N., Iqbal, J., & Nasrallah, J. (2025). The use of artificial intelligence in medical writings among Khyber Pakhtunkhwa doctors in terms of knowledge, attitude and practices. Annals of Medicine and Surgery, 18(3), 10–1097.
11. Saks, A. M. (2015). Re examination of antecedents and consequences of employee engagement. Journal of Organizational Effectiveness, 2(3), 250267.
12. Sharma, R., & Lal, P. (2020). The connection between Artificial Intelligence and employee engagement: Reaching out to the connections. International Journal of Human Resource Studies, 10(1), 7288.
13. Shoukat, K., Jian, M., Umar, M., Kalsoom, H., Sijjad, W., Atta, S. H., & Ullah, A. (2023). Use of digital transformation and artificial intelligence strategies for pharmaceutical industry in Pakistan: Applications and challenges. AI Horizons, 1(1), 32–41.
14. Topol, E. J. (2019). High performance medicine: The merging of human and artificial intelligence. Nature Medicine, 25(1), 44–56.
15. Vrontis, D., Chaudhuri, R., & Chatterjee, S. (2022). Adoption of digital technologies by SMEs for sustainability and value creation: Moderating role of entrepreneurial orientation. *Sustainability*, *14*(13), 7949.
16. Zaman, S. A. A., Jiang, Y., Dawood, H. M., Zafar, A., & Zaman, S. I. (2025). The potential to use knowledge management to achieve sustainable supply chain management in the pharma industry. Knowledge Management Research & Practice, 1–19.