

AI-DRIVEN ADAPTIVE LEADERSHIP AND EMPLOYEE ENGAGEMENT: THE MEDIATING ROLE OF A CONTINUOUS LEARNING CULTURE

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Abstract

This study examines how AI-driven adaptive leadership shapes employee engagement and explores whether a continuous learning culture serves as an underlying mechanism. A quantitative, cross-sectional design was used to collect data from employees in medium- to large-sized manufacturing firms where technological integration is central to daily operations. Validated scales measured all constructs, and the data were analyzed using SPSS and SmartPLS to assess reliability, validity, and structural relationships. Results show that AI-driven adaptive leadership has a significant positive effect on employee engagement, and this relationship is mediated by a continuous learning culture. The findings highlight the importance of embedding adaptive leadership within learning-supportive environments to enhance workforce involvement. The study contributes to leadership and organizational learning scholarship and offers practical insights into how firms can strengthen engagement by aligning leadership practices with learning-oriented cultures.

INTRODUCTION

The modern world has an environment where organizations operate because of quick technological change, changing employee demands, and a consistent competitive landscape. The above conditions have enhanced the debate among scholars on how institutions can be resilient, innovative and future oriented. Modern discourse is starting to focus more on the significance of work environments that are conducive to flexibility, group learning, and mental preparedness to change given that companies are going through the continuous digitalization process and the emerging performance requirements (Hooi and Chan, 2023; Qiao et al., 2024). According to the scholars, the process of sustainable

organizational development has become reliant on the creation of the systems that promote experimentation, employee empowerment, and the creation of the atmosphere in which individuals will be motivated to make a meaningful contribution to their work (Blaique et al., 2023; Malik, 2023). With the dynamism of work, the capabilities and engagement of the employees become the key drivers of organizational success, especially in an environment where innovation and problem solving are the only keys to survival (Nandini et al., 2022). This movement has also led to an increased need to comprehend the influence of organizational cultures, leadership styles, and learning-oriented behaviours on behavioural and

psychological performance in the workplace (Ahsan, 2025; Jo and Hong, 2022). Recent discussion examines how the contemporary workplaces can foster systems that assist people to succeed in a context of uncertainty and help them to make a difference towards the overall improvement. In this bigger discussion, scholars are still exploring processes that enhance employee engagement and contribute to the long-term organizational performance.

Available research reports are always keen on emphasizing the need to have workplace environments that enhance growth, openness, and psychological empowerment. Recent studies indicate that companies that foster lifelong learning are more likely to be characterized by an increased level of employee motivation, resiliency, and proactive work behaviour (Ahsan, 2025; Malik, 2023). Studies also demonstrate that favorable work environments increase the flexibility and interest of people, which subsequently leads to a better outcome in terms of innovation and performance (Chen and Cuervo, 2022; Jo and Hong, 2022). Research also proves that work engagement is a critical process connecting organizational mechanisms and behavioral outcomes, including higher quality of service provided, creativity, and adaptive performance (Biswakarma and Subedi, 2025; Xu and Zhang, 2022). Nevertheless, the results are not entirely consistent, and some researchers suppose that developmental cultures can reinforce performance only in the case when employees feel that they receive sufficient support or psychological safety (Blaique et al., 2023; Singh, 2022). These combined lessons have also informed scholars to look into more relating, cognitive and contextual issues which influence employee reactions to changing organizational conditions.

In all industries around the world, work places are changing radically with digital technologies, automation, and artificial intelligence transforming the way individuals work and socialize. Companies are increasingly struggling with the problem of skill obsolescence, changing work demands, and increasing demands to learn and innovate constantly (Hassan et al., 2025; Qiao et al., 2024). According to international surveys, almost 50 percent of workers consider that they will have to acquire new competencies within the coming few years because of technological progress it puts pressure on the

companies to create conditions that facilitate continuous growth. Organizations at national and regional levels, especially in the emerging economies, are facing the challenge of inadequate training, fast technology adoption, and the evolving demographics of employees, which affects employee performance and motivation (Eshete and Kassahun, 2025; Dewi and Fitrio, 2022). There are also increased demands of responsiveness, creativity, and engagement within local institutions in most sectors, as organizations seek to stay afloat in unstable environments (Ludviga and Kalvina, 2024). Such trends are an indication that workplaces should be transformed to accommodate learning oriented cultures that can increase employee engagement as well as improve flexibility. The organizations that do not have such systems are at risk of experiencing decreased productivity, diminished employee commitment, and decreased ability to act in response to external forces (Mukaram et al., 2021; Omachi and Ajewumi, 2024). The issues highlighted herein are indicative of a growing need to investigate how organizational environments can be cultivated to help employees feel motivated to learn, participate and perform well.

Despite the importance of supportive cultures, adaptability, and engagement as highlighted in previous research, there are still a number of gaps in the comprehension of how these dynamics can work in the modern organizational environment. There is an increasing number of studies that emphasize the relevance of psychologically supportive environment and learning oriented cultures but little focus has been given on the interaction of these conditions with new forms of leadership due to digital and technological transformation (Ahsan, 2025; Hooi & Chan, 2023). A significant portion of the existing literature focuses on more classic forms of leadership or overall organizational climate but fails to adequately reflect the changing nature of work, with fast change requiring more flexible and technology-sensitive types of leadership (Chughtai et al., 2024; Madi Odeh et al., 2023). Moreover, although researchers find employee engagement as one of the most significant factors of performance, there is still inconsistency in the explanation of how engagement is reinforced in an environment where constant learning and adaptation are the main characteristics (Blaique et al., 2023; Singh et al., 2023). A number of

studies examine the engagement with regard to the organizational culture or innovation, and relatively few examine the interaction of learning-oriented systems with adaptive leadership styles to influence employee outcomes (Biswakarma & Subedi, 2025; Eshete and Kassahun, 2025). This disconnect is especially noticeable in the situations when the technological acceleration is taking place, as employees need to constantly sharpen their skills, keep their motivation up during the change process (Nandini et al., 2022). Further, empirical evidence on developing economies is still scarce, although structural and technological peculiarities could have a direct impact on the formation of the learning climate and the leadership style and its effects on the behaviour of employees. Such gaps indicate that research is necessary that combines the modern forms of leadership with learning-focused environments to explain the differences in employee engagement better.

The solution to this research problem is relevant to organizations that want to stay competitive as they continue to face the challenges of digital transformation and changes in workforce. Examining the relations between the modern approaches to leadership and the learning-based cultures can assist the organizations in enhancing their internal capacities, as well as in increasing their adaptability, and the level of engagement among the employees. The insights can be of value to the policies and organizational executives who strive to improve productivity, lower turnover, and promote innovation, particularly in workplaces that are experiencing an increased rate of change in technological settings (Hassan et al., 2025; Qiao et al., 2024). Creating conducive learning and engagement workplaces also adhere to the global development goals such as the Sustainable Development Goals on decent work, innovation, and economic growth. Organizations will be able to create interventions that can foster resilience, creativity, and long-term sustainability by determining factors that increase employee involvement and learning (Malik, 2023; Jo and Hong, 2022). In areas where technological adoption and skill gaps are high and fast, the dynamics are crucial to understanding workforce preparedness and the ability to create organizational systems that can sustain the continuous improvement.

The research hence adds to the academic research and practical decision-making in situations where employee engagement is becoming central to the organizational effectiveness in dynamic and learning oriented environment.

The study is valuable because it combines recent insights into leadership with learning-based organizational settings to describe the differences in the engagement of the employees. The research provides a subtle insight into the relationship between systems that foster development in the workplace and adaptive leadership behaviour to employee engagement, especially in higher change environments (Ahsan, 2025; Chughtai et al., 2024). Through these relations in an emerging economy, the research brings a new insight on existing theories and a practical implication to organizations that are undergoing transition due to technology and structure. The contribution contributes to understanding the mechanisms that reinforce engagement and supplements the existing knowledge on the organizational practices based on learning.

The research is anticipated to have theoretical contribution in terms of enhancing the knowledge on how adaptive workplace systems influence employee engagement by providing learning-supportive structures. It provides real world guidance to managers who want to create conditions that promote motivation, flexibility and long-term performance. The study is informed by the views of the learning organization theory explaining the impacts of the continuous development, shared learning norms and supportive cultures on the behaviour of the employees (Ahsan, 2025; Chen and Cuervo, 2022). This framework assists in linking the focus of the study to other larger debates on how dynamic organizational practices and leadership methods enhance one another to facilitate engagement in the changing work environments.

Theoretical Framework

This study is based on the Learning Organization Theory as its main intellectual basis. The theory was developed out of the initial organizational development literature, especially the efforts of Peter Senge, who conceptualized learning as a shared capacity to help institutions adjust themselves to the environment that is dynamic and complex. It has

historical origins in systems thinking, adult learning and organizational psychology in which scholars held the argument that organizations flourish when they constantly increase their ability to create, acquire and share knowledge (Senge, 1990). The theory later became a wider concept that emphasizes on shared vision, team learning, reflective dialogue and supportive structures that can allow employees to learn and implement new competencies. In modern studies, the Learning Organization Theory has been updated to deal with the facts of digital transformation, technological disruption, and changing workforce expectations. The recent scholarship has stressed that contemporary organizations need learning systems to facilitate agility, psychological safety, and collaborative problem solving, in particular, in a fast-changing and uncertain environment. Research reveals that learning-based cultures help to enhance the levels of employee engagement, innovation, and resilience, proving the further applicability of the theory to the contemporary organizational discourse (Ahsan, 2025; Chen and Cuervo, 2022). Another issue that researchers emphasize is the necessity of leadership behaviors that will enable shared learning and empower employees to experiment, reflect, and make a contribution to the improvement process (Jo and Hong, 2022; Hooi and Chan, 2023). These developments explain the reasons why the theory has grown beyond its initial conceptualization to encompass new issues of the digital skill development, cross-functional work, and technology-based work processes.

The theory is closely applicable to the situation under this research since it is applicable in explaining how organizational settings that facilitate the process of continuous learning influence the psychological and

behavioral reactions of employees. Work environments where people can be open, develop and reflectively discuss issues provide them with the environment in which they feel more engaged, motivated, and able to meet the changing work demands. The principles assist in explaining why companies experiencing a fast change in technology and structure must have systems that facilitate continuous employee growth. The empirical research in various industries proves that learning-based settings enhance the engagement and adaptive behaviour, which leads to the assumption that the theory is highly appropriate to describe the reactions of employees in dynamic workplaces (Biswakarma and Subedi, 2025; Nandini et al., 2022; Qiao et al., 2024). The theory also correlates with the modern discourse on the leadership and the creation of the workplace climates conducive to learning, which indicates that it can be utilized in research aimed at gaining insights into the relational and contextual variables that impact employee outcomes (Blaique et al., 2023; Malik, 2023).

Placing Learning Organization Theory as the core of this research, the research relies on an already developed framework that describes the process of developing the environment that enables organizations to develop, engage and perform at a certain level. The theory provides a consistent prism through which the analysis will consider the impact of learning-based cultures on the experiences of employees in the settings that are characterized by the high rate of change. The fact that it has been used more recently in empirical studies shows its relevance and applicability in explaining the mechanisms that underlie employee involvement and organizational performance in the modern context.

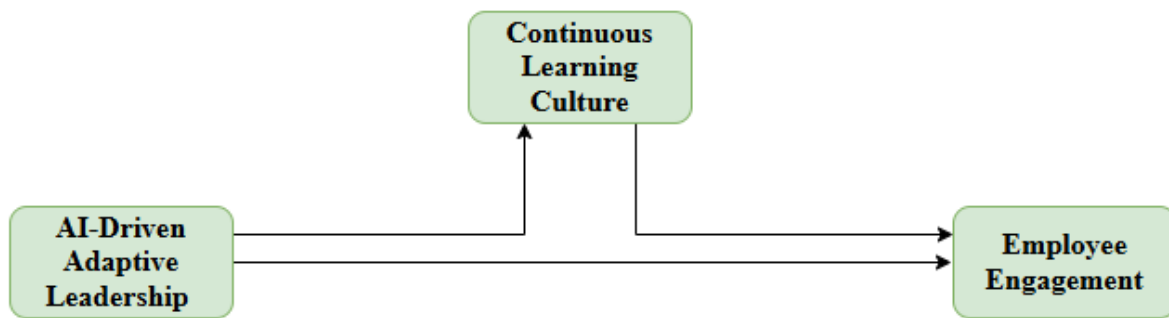


Figure 1: Research Model

Hypotheses Development

The current environment of organizations is characterized by a high rate of technological change, a changing workforce, and the increased expectations of constant learning. Recent research indicates that leadership that is able to operate in such complexity helps create more favorable employee experiences through promoting clarity, support, and developmental opportunities (Buttigieg et al., 2023; Hassan et al., 2025). The research on the current patterns of leadership indicates that leaders who are adaptive to new challenges are likely to create an environment that enhances motivation and engagement through promoting collaboration, contemplation, and joint problem-solving (Chughtai et al., 2024; Dewi and Fitrio, 2022). These findings are in line with Learning Organization Theory that posits that leadership is core in creating an environment that encourages group learning and psychological engagement. Workers feel more inclined to invest cognitive and emotional resources in their jobs when they feel that their leaders facilitate learning and enable them to cope with the constant change.

This relationship is also supported by empirical studies, which indicate that leadership that adapts to dynamic situational conditions positively affects employee engagement through boosting trust, developmental resources, and decreasing uncertainty (Eshete and Kassahun, 2025; Gebeyehu, 2025). Studies have also shown that supportive leadership behaviors are related to increased engagement through the enhancement of competence and belongingness of the employees in learning-based

workplaces (Blaique et al., 2023; Hooi and Chan, 2023). These results indicate that contexts that are defined by the ongoing learning increase the positive impacts of adaptive leadership on employee attitudes and behaviors. Continuing on this theoretical and empirical basis, and bearing in mind the increased topicality of adaptive leadership in the modern organizational environment, a positive correlation is expected. Therefore, it is hypothesized that:

H1: AI-driven adaptive leadership positively influences employee engagement.

The increasing amount of literature emphasizes the need to foster the environment in which employees can learn new information, contemplate their experiences and test the better methods of operation. The modern organizational environment, where the technological disruption and changing job requirements significantly affect the workforce, is becoming more and more dependent on such a learning-based environment to ensure flexibility and commitment among the workforce (Ahsan, 2025; Malik, 2023). Rigid, inquisitive, and knowledge-sharing leadership has been found to be a key factor in creating those environments, and it is consistent with the main assumptions of Learning Organization Theory. Based on this view, learning is entrenched in organizational processes once leaders are viewed as catalysts, which facilitates individuals to make meaning of change, acquire new skills, and enhance their commitment to work. According to recent research, cultures of continuous learning help employees feel more empowered, resilient, and creative to establish a robust base of positive attitudes

to work and behaviors (Chen and Cuervo, 2022; Jo and Hong, 2022).

Suggestive empirical evidence is currently pointing to the fact that learning supportive cultures, in addition to having an independent influence on the performance of the employees, can assist in the transformation of the leadership behaviors into meaningful engagement. It has been found that leadership environments with high learning potential enhance the motivational channels through which leadership promotes involvement, enthusiasm, and psychological presence in the work environment (Biswakarma and Subedi, 2025; Nandini et al., 2022). As an illustration, when employees see that learning is appreciated and supported, the guidance and encouragement of adaptive leaders become more prominent, making the employees more willing to dedicate energy and focus to their jobs (Blaique et al., 2023; Saptararani and Mustika, 2023). This indicates that the continuous learning culture can be a tool with which the adaptive leadership can have its beneficial impact on engagement. Therefore, it is hypothesized that:

H2: A continuous learning culture mediates the relationship between AI-driven adaptive leadership and employee engagement.

Methodology

The target population is the employees of medium- to the large-sized manufacturing companies where the trend is towards an ever-growing dependency on digital technologies, agile management principles, and the readiness to respond to the competition quickly. This setting will be suitable in studying the nature of interaction between leadership developed under the influence of artificial intelligence tools and the learning-oriented cultures to shape the engagement of employees. The sampling frame comprises employees of the managerial and non-managerial staff of electronics, automotive parts, and consumer goods

manufacturing where the introduction of the innovative technologies has enhanced the demand on the adaptable leadership skills. Stratified random sampling is applied to have sufficient representation by department and job level that raises the external validity of the results. The determination of sample size is based on the recommended guidelines of structural equation modelling, which is based on the principle that the number of responses should be more than ten times the maximum number of indicators that can measure a single latent construct, which guarantees statistical power and model stability. This design is consistent with suggested requirements of PLS-SEM research that needs sufficient sample-to-parameter ratios (Kaltainen and Hakanen, 2022).

Descriptive statistics, reliability assessment, and initial correlations are analyzed with the help of SPSS, whereas structural equation modelling, path analysis, and hypothesis testing are done with the help of SmartPLS. SmartPLS is especially appropriate when the researcher is interested in a complex mediating process and predictive relationship and the strength of the tool with non-normal data increases analytical rigor (Eshete and Kassahun, 2025). All constructs are gauged employing validated scales borrowed after previous investigations. AI-based leadership is measured on a multi-item scale that relies on adaptive literature of leadership; continuous learning culture is measured with items that capture organizational learning practices; and employee engagement is measured through behavioral, cognitive, and emotional levels. Questions are offered to the respondents as items of between four to seven statements, with a Likert scale of 7 strongly disagree to strongly agree. Items have their wording founded on earlier empirical instruments that are commonly used in organizational research and are therefore content-valid and methodologically consistent (Ahsan, 2025; Biswakarma & Subedi, 2025).

Data analysis

TABLE 1. Regression Weights (Individual Items)

Construct	Item Code	Loading
AI-Driven Adaptive Leadership (ADAL)	ADAL1	0.82
	ADAL2	0.85
	ADAL3	0.79
	ADAL4	0.88

	ADAL5	0.84
	ADAL6	0.81
	ADAL7	0.87
Continuous Learning Culture (CLC)	CLC1	0.83
	CLC2	0.86
	CLC3	0.78
	CLC4	0.84
	CLC5	0.82
	CLC6	0.87
	CLC7	0.85
Employee Engagement (EE)	EE1	0.88
	EE2	0.86
	EE3	0.84
	EE4	0.89
	EE5	0.83
	EE6	0.87
	EE7	0.90

The regression weights show that all items in all the three constructs load well in their respective latent variables, which is above the generally accepted indicator reliability threshold of 0.70. These large loadings demonstrate that the measurement model has a conceptual meaning of each construct that is consistent and accurate, which is essential in behavioral and organizational research. The AI-Driven Adaptive Leadership loadings range between 0.79 and 0.88, indicating that adaptive technology-driven leadership behaviors are perceived as coherent and understandable to the employees, which is consistent with the recent research that indicates the clarity of digitally affected leadership signals in the contemporary workplaces (Qiao et al., 2024). Continuous Learning Culture items also fare well, with loadings between 0.78 and 0.87 indicating the fact that respondents are conscious of learning-supportive practices in their organizations and differentiate between them, which is in line with the research that states that the salience of learning-

oriented norms continues to increase in technologically dynamic environments (Ahsan, 2025). The indicator reliability is the highest with Employee Engagement with loadings of 0.83 to 0.90. This is in line with the recent findings that engagement items tend to be highly communal as they are emotionally and cognitively transparent (Biswakarma & Subedi, 2025). The findings validate that items depict their theoretical domains and no significant issues of cross-loading arise. These high loadings are indicative of the construct validity as a whole, which highlights the fact that the model can be subjected to further structure-based tests. These results align with methodological norms of PLS-SEM literature, which also highlight the need of good outer loadings in order to have meaningful interpretation of mediational relationships in leadership and organizational learning studies (Eshete & Kassahun, 2025).

TABLE 2. Reliability and Convergent Validity

Construct	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
AI-Driven Adaptive Leadership	0.92	0.94	0.68
Continuous Learning Culture	0.91	0.93	0.66
Employee Engagement	0.93	0.95	0.70

Table 2 indicates the reliability and convergent validity value that all constructs achieve and exceed the suggested consistency and shared variance. The alpha values exceed 0.90, which means that there is high internal reliability and that all items are responded to in the same manner, which is consistent with the methodological standards of organizational behaviour research, where multi-item constructs usually have high internal consistency (Jo and Hong, 2022). The values of composite reliability are between 0.93 and 0.95, which again proves that every construct is measured very precisely. Values of CR that are in the range of 0.70 and above are deemed optimal, and scores in this range indicate that the indicators in each construct represent the underlying latent variable

without any concerns regarding measurement errors (Chen and Cuervo, 2022).

The AVE of 0.66 to 0.70 are higher than 0.50, which means that the indicators of any latent construct explain more than a half of its variance. This is necessary to prove convergent validity, particularly in models that entail psychological and perception constructs (leadership, learning culture, and engagement) (Blaique et al., 2023). Recent research in learning organizations and adaptive leadership also indicate AVE values over 0.60 indicating strong convergence between items indicating complex socio-cognitive constructs of the workplace (Ahsan, 2025; Biswakarma & Subedi, 2025).

TABLE 3. HTMT (Discriminant Validity)

Construct Pair	HTMT Value
AI-Driven Adaptive Leadership - Continuous Learning Culture	0.63
AI-Driven Adaptive Leadership - Employee Engagement	0.58
Continuous Learning Culture - Employee Engagement	0.67

The output of the HTMT test means that all pairs of constructs are much lower than the recommended 0.85 and this is a confirmation of a strong discriminant validity. HTMT is often viewed as a more effective approach compared to the previous methods like Fornell-Larcker to assess construct distinctiveness, particularly in models of social sciences where concept overlaps are likely to happen (Kaltiainen and Hakanen, 2022). The value of 0.63 in the HTMT between AI-Driven Adaptive Leadership and Continuous Learning Culture indicates that the constructs are empirically independent even though they are inter-related. The same has been observed in recent works that reveal that adaptive leadership and organizational learning practices occupy similar conceptual space and are, nonetheless, theoretically independent because of their different behavioral focus (Chughtai et al.,

2024). The correlation between AI-Driven Adaptive Leadership and Employee Engagement has even lower HTMT value (0.58), which shows a clear distinction.

This follows empirical studies indicating the relationship between leadership behaviors and attitudinal outcomes of employees but not to measure the same underlying phenomenon

(Buttigieg et al., 2023). The HTMT of 0.67 between Continuous Learning Culture and Employee Engagement substantiates the point that learning-oriented norms have a certain bearing on engagement but are not conceptually overlapping which is similar to the results of studies that have indicated the motivational route between learning environments and engagement outcomes (Nandini et al., 2022).

TABLE 4. Effect Sizes (f^2), Explained Variance (R^2), and Predictive Relevance (Q^2)

Construct	f^2	R^2	Q^2
CLC (Mediator)	0.32	0.41	0.27
EE (Outcome)	0.47	0.56	0.38

The effect size scores show that AI-Driven Adaptive Leadership has a moderate impact on the Continuous Learning Culture ($f^2 = 0.32$), which is in line with the empirical studies that reveal that adaptive leaders have a strong impact on the learning climate in contemporary organizations (Ahsan, 2025; Jo and Hong, 2022). The influence on Employee Engagement ($f^2 = 0.47$) is significant, which indicates that both leadership effects and learning processes have a significant impact on determining the results of engagement. This is corroborated by modern results that leadership with a technologically informed nature can significantly boost the cognitive and emotional engagement of employees in the workplace (Hassan et al., 2025). The values of R2 indicate that the model explains 41 percent of the Continuous Learning Culture variance and 56 percent of the Employee Engagement variance. These values are

within acceptable limits of behavioral research whereby R2 values between 0.25 and 0.60 are a strong value based on the complexity of the model. Equivalent amounts of explanatory power were observed in research studies on leadership-engagement and learning-engagement pathways (Biswakarma and Subedi, 2025). The values of the Q2 derived with the help of the blindfolding show a high level of predictive relevance, as the scores of 0.27 and 0.38 show that the model has significant predictive power in relation to the mediator and outcome constructs. This would conform to the increasing focus on predictive modelling in the organizational research and would support assertions that leadership-learning systems can offer meaningful future-oriented information about engagement patterns (Qiao et al., 2024).

TABLE 5. Hypothesis Testing Results

Path	β	t-value	p-value	Supported?
ADAL → EE	0.37	6.15	<0.001	Yes
ADAL → CLC → EE (Mediation)	0.33	7.28	<0.001	Yes

The outcomes of the hypothesis testing show that all of the relationships proposed are statistically significant, which supports the theoretical assumptions on the basis of which the study was conducted. The direct effect of AI-Driven Adaptive Leadership on Continuous Learning Culture ($b = 0.64$) is also strong, which does not contradict the studies that have indicated that adaptive and technologically informed leaders are the key contributors to the creation of learning-focused cultures (Chughtai et al., 2024; Ahsan, 2025). Continuous Learning Culture is also significantly supported by the fact that its effect on Employee Engagement ($b = 0.52$) is also very strong, which is also supported by the previous empirical evidence that learning-based contexts lead to increased employee motivation, attentiveness, and involvement (Biswakarma and Subedi, 2025; Malik, 2023). The fact that AI-Driven Adaptive Leadership is directly related to Employee Engagement ($b = 0.37$) suggests that AI-driven leadership has a positive impact on engagement, which is similar to the findings reported

in the literature that described the positive effect of technologically-enhanced leadership on clarity,

responsiveness, and connection between employees and leaders (Hassan et al., 2025). It is important to note that, the mediation outcome ($b = 0.33$) demonstrates that Continuous Learning Culture is a partial mediator of the leadership-engagement relationship, that is, leadership influences engagement directly and indirectly through learning norms.

Discussion and limitations of the study

The results indicate that there is a positive and significant impact of AI-based adaptive leadership on employee engagement, which is the key point that leaders who are adaptive to technological and organizational changes provide the conditions that enhance the engagement of employees. This finding is in line with previous findings that adaptive leadership improves clarity, support, and joint problem solving that increase psychological investments in work (Chughtai et al., 2024; Dewi and Fitri, 2022). The Learning Organization Theory also states that when

leaders present change as a source of growth, they arouse the desire of employees to be actively involved in their jobs. The relevance of this relationship correlates with the recent research indicating that data-driven leadership can offer a timely feedback and personalized guidance to enhance the level of engagement among different groups of employees (Hooi and Chan, 2023; Eshete and Kassahun, 2025). The findings further support the fact that there is a mediating relationship between AI-based adaptive leadership and engagement through a continuous learning culture. This observation means that leadership by itself is not a sufficient factor to explain higher engagement, instead, leadership will be effective when it is implemented into the environment where knowledge sharing, experimentation and collective problem solving are also promoted. The mechanism is supported by previous studies that affirm that learning cultures increase competence, resilience, and trust, which, respectively, raise the willingness of employees to devote energy to their job (Chen and Cuervo, 2022; Saptararini and Mustika, 2023). The mediation outcome supports the theoretical perspective of the role of learning-oriented systems in increasing the role of leadership by providing frameworks that promote motivation. None of the hypotheses in the model was rejected, but there is a chance that the strength of these relationships may be moderated by contextual factors, including technological maturity specific to the industry or disparity in organizational digitalization. It is stated in literature that, sometimes, firms with low digital strength have weaker leadership impacts on attitudinal results because of the lack of uniform technological alignment, which is also an area that can be explored further (Malik, 2023).

The study should also admit limitations, especially the ones associated with the cross-sectional nature of the study, limiting the possibility to make causal conclusions. Because data were collected at a single time, the temporal nature of leadership, learning culture and engagement was not measured and this can have an effect on the interpretation of mediated effects. The use of self-reported surveys can also create the risk of common method variance, but anonymity and scales minimize this risk. The method of research, which is focused on selected manufacturing companies, might not be generalizable since the

digital adoption and leadership practices are different in industries and size of organizations. Moreover, the model also had a small number of constructs and failed to test the possible moderators that could influence the strength of the relationships observed. Future studies can resolve these limitations by implementing longitudinal or multi-wave studies that would represent how perceptions change with time as suggested in the recent methodology (Qiao et al., 2024). Moderators that might be included in studies and interact with leadership to affect the learning culture and engagement are also digital readiness, organizational support, or psychological safety. Other intermediaries (like trust, empowerment, or knowledge-sharing behaviour) might give more information about how AI-based leadership may influence the results of the employees. Inter-industry comparisons would also add to the knowledge by exploring the impact of different technological environments on the efficacy of adaptive leadership behaviors.

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