Research Article

Fostering Employee Innovation through Authentic Leadership: The Mediating Role of Technology Diversity in the Telecom Industry of Pakistan

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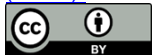
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ABSTRACT

This study investigates the relationship between authentic leadership and employees' innovation, with a particular focus on the mediating role of technological diversity in Pakistan's telecommunication sector. Drawing upon authentic leadership theory, the research conceptualizes leadership through four key dimensions: self-awareness, relational transparency, balanced processing, and internalized moral perspective. A quantitative, cross-sectional research design was adopted, and data were collected from 379 executive-level employees across four major telecommunication companies—Jazz, Telenor, Ufone, and Zong—using proportionate stratified random sampling. Structural Equation Modelling (SEM) using AMOS was employed for data analysis. The findings confirm that authentic leadership positively influences employees' innovation and that technological diversity partially mediates this relationship. The results highlight the strategic importance of integrating ethical leadership with technological capability to foster innovation in fast-evolving and competitive industries. The study contributes both theoretically and practically by emphasizing the role of leadership style and technological resources in driving innovation performance in emerging market contexts.

KEYWORDS

Authentic Leadership; Employees' Innovation; Technological Diversity; Telecommunication Sector; Structural Equation Modelling; Pakistan

1 | INTRODUCTION

Pakistan's telecommunication sector plays a pivotal role in driving the country's economic development. Beyond offering employment to millions, it significantly contributes to advancing digital connectivity, facilitating information exchange, and promoting the adoption of modern technologies (Hussain et al., 2021). The widespread use of mobile phones, internet access, and data services has enhanced efficiency across both public and private sectors. Employees in this industry possess not only strong technical expertise but also the adaptability to thrive amid rapid technological changes (Sony & Mekoth, 2022). Their creativity, innovative thinking, and technical versatility are critical assets that propel organizational innovation. In this context, a leadership style grounded in self-esteem, integrity, and transparency is essential (Choi et al., 2024). Such leadership fosters an environment that nurtures innovation and enhances the innovative potential of employees within the sector. Pakistan's telecommunication sector has emerged as a cornerstone of modern development, digital connectivity, and economic resilience (Jabeen et al., 2024). Leadership plays a critical role in shaping the growth and transformation of this sector. Leaders serve as the bridge between an organization's vision and its workforce, guiding employees toward shared goals and aligning them with the institution's strategic direction (Chin, 2024). Effective leadership not only motivates employees to achieve organizational objectives but also fosters a culture of creativity, innovation, and technological adaptability. In today's fast-paced environment—where telecommunication companies face rapid technological advancements, increasing consumer expectations, and constant market disruption—there is a growing need for leadership that embodies trustworthiness, transparency, and strong moral values (Ogbeibu et al., 2024). Such leadership cultivates meaningful relationships with employees, inspiring them through a sense of self-worth,

purpose, and forward-thinking. This approach, known as Authentic Leadership, creates a workplace culture where individuals feel empowered to share ideas openly, reflect on experiences, and contribute meaningfully to organizational performance and innovation (Nawaz & Tian, 2022).

Employee innovation plays a pivotal role in enhancing organizational performance (Ashiru et al., 2022), particularly in dynamic and technology-driven industries such as telecommunications. It involves the generation, promotion, and implementation of new ideas by employees to improve products, services, or internal processes. Innovative employees contribute directly to an organization's ability to respond to market changes, improve customer satisfaction, reduce operational inefficiencies, and maintain competitive advantage (Arhin & Cobblah, 2024). In today's globalized business environment, where rapid technological advancement is the norm, fostering innovation at the employee level is no longer optional—it is essential for long-term sustainability. Authentic leadership is increasingly recognized as a key driver of employee innovation (Gelaidan et al., 2024). Characterized by self-awareness, relational transparency, ethical conduct, and balanced decision-making, authentic leaders create a psychologically safe and trustworthy environment. Such leaders encourage open communication, value employee input, and foster mutual respect—conditions that empower employees to think creatively and take initiative without fear of criticism or failure. By modelling integrity and openness, authentic leaders inspire employees to align their values with organizational goals, which enhances intrinsic motivation and drives innovative behaviour (Yamak & Eyupoglu, 2021). In sectors like telecommunications, where responsiveness and adaptability are crucial, authentic leadership can significantly improve the innovation culture across the organization. Though employee innovation is a critical determinant of organizational success in Pakistan's telecommunications sector, it remains underutilized due to structural, cultural, and leadership-related barriers. Although authentic leadership has been identified as a positive influence on innovation, there is limited empirical understanding of how it functions in environments characterized by rapid technological change and hierarchical organizational norms. Furthermore, the mechanisms through which authentic leadership translates into innovative behaviour—such as the presence of technological diversity—are not well-explored in the local context. Therefore, this study seeks to investigate the impact of authentic leadership on employee innovation, and to examine the mediating role of technological diversity in Pakistan's telecommunication sector.

Technological diversity refers to the presence and integration of a wide range of technological tools, systems, platforms, and expertise within an organization (Zamiri & Esmaeili, 2024). In today's rapidly evolving digital landscape, technological diversity has become a strategic asset that enables organizations to remain competitive, responsive, and innovative. It facilitates the blending of different technical perspectives, methodologies, and problem-solving approaches, allowing teams to tackle complex challenges more effectively. By leveraging a variety of technologies, organizations can optimize workflows, improve decision-making, and enhance their ability to adapt to changing market demands (Zaiter & Azouz, 2025). One of the key benefits of technological diversity is its capacity to stimulate innovation (Feng et al., 2022). When employees have access to diverse technological resources, they are more likely to experiment with new combinations of tools, generate novel ideas, and implement creative solutions. This diversity encourages cross-functional collaboration, as individuals with different technological backgrounds share knowledge and learn from each other (Dussart et al., 2021). It also enables the organization to explore multiple pathways to achieving goals, rather than relying on a single system or rigid process. Despite the well-recognized importance of employee innovation in enhancing organizational performance, many firms, particularly in developing countries like Pakistan, struggle to foster an environment where innovation can thrive (Nasir et al., 2022). One of the key challenges is the lack of enabling leadership styles that promote psychological safety, open communication, and trust among employees. While authentic leadership—marked by transparency, self-awareness, and ethical conduct—has shown potential in encouraging innovation (Born et al., 2025), its application is often limited by organizational hierarchies, rigid cultures, and inconsistent leadership practices.

Another major problem lies in the inadequate technological infrastructure or lack of diversity in technological resources within many organizations. Even when leaders support innovation, employees may lack access to the technological tools, systems, or platforms required to execute their ideas (Nguyen et al., 2024). In such environments, the absence of technological diversity limits employees' ability to experiment, collaborate, or implement creative solutions effectively. This creates a disconnect between leadership intentions and actual innovative behaviour at the employee level. Moreover, there is limited empirical research examining the mechanism through which authentic leadership leads to innovation, particularly in the context of Pakistan's telecommunication sector. While the direct link between leadership and innovation has been explored, the potential mediating

variables—like technological diversity—that might explain how or why this relationship occurs are still under-investigated. Based on the identified gaps and challenges, this study proposes the following research questions (RQs):

RQ1: What is the influence of authentic leadership on employees' innovative performance in Pakistan's telecommunication sector?

RQ2: Does technological diversity mediate the relationship between authentic leadership and employees' innovation?

This study holds both theoretical and practical significance by bridging the gap between leadership theory and innovation research, particularly within the context of Pakistan's telecommunication sector. Theoretically, it extends the understanding of authentic leadership by exploring its influence on employee innovation through the mediating role of technological diversity—an area that remains underexplored in emerging economies. Practically, the study provides valuable insights for organizational leaders and decision-makers by highlighting how ethical, transparent, and supportive leadership can foster a culture of innovation when complemented by a diverse technological environment. The findings can inform leadership development programs, digital infrastructure investments, and innovation strategies aimed at enhancing employee performance and sustaining competitive advantage in a rapidly evolving industry.

2 | LITERATURE REVIEW

2.1 | Authentic Leadership Theory

Authentic leadership theory has gained considerable attention in recent years as a positive and ethical leadership approach that promotes trust, engagement, and innovation in the workplace. Rooted in positive psychology and ethical leadership literature, authentic leadership emphasizes the leader's genuineness, self-consistency, and integrity in interactions with followers (Walumbwa et al., 2008). Unlike traditional leadership styles that often rely on control or charisma, authentic leadership focuses on building credibility and long-term influence through ethical conduct and personal authenticity. This leadership style has been shown to foster psychological safety, enhance employee well-being, and facilitate innovative behaviour across diverse organizational settings. Authentic leadership is typically conceptualized through four core components: self-awareness, relational transparency, balanced processing, and internalized moral perspective (Almutairi et al., 2025). Self-awareness refers to the leader's understanding of their own strengths, weaknesses, emotions, and values (Bratton et al., 2011). Leaders who are self-aware are better able to regulate their behaviour, make ethical decisions, and remain consistent in challenging situations (Ilies et al., 2005). In the context of innovation, self-aware leaders are more open to feedback and change, which encourages employees to voice new ideas and explore creative solutions. Relational transparency involves openly sharing one's thoughts, feelings, and intentions with others while fostering a culture of honesty and openness (Rego et al., 2022). Leaders exhibiting relational transparency build trust by being genuine in their interactions, admitting mistakes, and communicating with integrity. This open communication creates a psychologically safe environment where employees feel comfortable expressing their innovative ideas without fear of judgment or reprisal (Gardner et al., 2005).

Balanced processing refers to the leader's ability to objectively analyse relevant information before making decisions, including actively seeking out and considering opposing viewpoints (Lord & Maher, 2002). Such leaders demonstrate fairness and inclusiveness, making employees feel valued and respected. This quality helps promote a collaborative atmosphere, which is conducive to knowledge sharing and the generation of innovative solutions (Walumbwa et al., 2008). Internalized moral perspective denotes the leader's strong moral and ethical standards, which guide their behaviour and decisions regardless of external pressures (Alavi, 2024). Leaders with this quality act consistently with their core values, earning the trust and respect of their followers. Employees working under such leadership are more likely to feel ethically aligned with the organization and become intrinsically motivated to contribute to innovation (Avolio & Gardner, 2005). Collectively, these four components of authentic leadership create an organizational climate that nurtures trust, learning, and empowerment—critical elements for fostering employee innovation. Particularly in rapidly evolving industries like telecommunications, authentic leadership provides a foundation for adaptive, forward-thinking, and ethically driven innovation.

2.2 | Telecommunication Sector of Pakistan

Pakistan's telecommunications sector has undergone impressive growth over the past two decades due to rapid technological advancements, privatization, and supportive policy frameworks. From 1995 to 2015, the number of telecom users rose dramatically from 0.1 million to 125.8 million, while cellular tele density increased from 2.8% to 67.4%. This growth attracted over $9 billion in foreign direct investment and $18 billion in total sector investments, significantly contributing to the country's GDP and government revenue (Din et al., 2016). The introduction of 3G and 4G services has enabled the expansion of digital services such as e-health, e-education, and mobile banking. Despite its successes, the industry faces persistent challenges, including regulatory hurdles, organizational inefficiencies, financial volatility, and strong market competition. Continuous innovation and learning are essential for sustaining its growth trajectory and maximizing its economic and social impact (Samad & Faraz, 2024).

2.3 | Employees' Innovation

Employees' innovation refers to the intentional introduction and application of new ideas, processes, or practices by individuals or teams within an organization to improve performance, solve problems, or enhance service and product quality (Sadikoglu & Zehir, 2010). Unlike top-down innovation, which is driven by upper management or specialized R&D departments, employee innovation emerges from the bottom-up and reflects employees' proactive engagement, creative thinking, and willingness to contribute beyond routine job roles. In knowledge-intensive and fast-paced industries like the telecommunication sector, employee innovation is increasingly regarded as a vital driver of organizational agility, adaptability, and competitive advantage (Mohanty et al., 2024). The literature categorizes employee innovation into three primary stages: idea generation, idea promotion, and idea realization (Scott & Bruce, 1994). Idea generation involves identifying problems or opportunities and proposing novel solutions. Idea promotion requires the support of colleagues or superiors to develop and refine those ideas. Finally, idea realization refers to implementing the ideas into tangible changes or improvements in processes, services, or products. Each of these stages requires not only individual creativity but also a supportive organizational environment, access to resources, and trust in leadership (Volery & Tarabashkina, 2021).

Several factors influence employees' innovative behaviour, including intrinsic motivation, psychological empowerment, job autonomy, organizational support, and leadership style (Amabile, 1997; Shalley et al., 2004). Among these, leadership plays a pivotal role. Leaders who support, recognize, and reward innovative efforts create a climate in which employees feel safe to take risks and explore new ideas. Authentic leadership, in particular, has been found to promote employee innovation by fostering openness, ethical values, and mutual trust—elements critical to encouraging knowledge sharing and experimentation (Rego et al., 2012). In the context of Pakistan's telecommunication sector, fostering employee innovation is particularly important due to constant technological disruption, high consumer expectations, and market competition. However, employees in such environments often face barriers such as rigid hierarchies, limited technological resources, and fear of failure, which can suppress innovation. Therefore, leadership that cultivates psychological safety, ethical decision-making, and open dialogue becomes essential for unlocking the innovative potential of employees.

2.4 | Hypothesis Development

2.4.1 | Authentic Leadership and Employees' Innovation

Authentic leadership has been increasingly recognized as a key antecedent of innovative behaviour in organizational settings (Laguna et al., 2019). Characterized by self-awareness, relational transparency, balanced information processing, and an internalized moral perspective, authentic leaders foster a work environment that promotes trust, openness, and psychological safety—factors essential for nurturing employee innovation (Walumbwa et al., 2008). When employees perceive their leaders as ethical, consistent, and supportive, they are more likely to engage in creative thinking and contribute novel ideas without fear of rejection or criticism. Research indicates that authentic leadership encourages employees to go beyond their formal job responsibilities, take initiative, and engage in problem-solving through innovative approaches (Rego et al., 2012). The transparent and inclusive nature of authentic leadership also helps reduce hierarchical barriers, allowing employees to voice suggestions and challenge existing practices constructively. In dynamic and competitive sectors such as telecommunications, where organizations must constantly innovate to remain relevant, authentic leadership can be a powerful catalyst for unlocking employees' creative potential. Therefore, the following hypothesis is proposed:

H1: Authentic leadership has a positive and significant influence on employees' innovation in Pakistan's telecommunication sector.

2.4.2 | Components of Authentic Leadership

Authentic leadership is a higher-order multidimensional construct that is composed of four distinct but interrelated components: self-awareness (SA), relational transparency (RT), balanced processing (BP), and internalized moral perspective (IMP) (Walumbwa et al., 2008). Each of these components contributes significantly to the overall effectiveness and authenticity of a leader. Together, they form the foundation of authentic leadership by shaping the leader's behaviour, ethical conduct, and interaction with followers. Self-awareness (SA) refers to a leader's conscious knowledge of their strengths, limitations, emotions, and values (Pretorius & Plaatjies, 2023). It allows leaders to remain grounded and act consistently with who they truly are, thereby building authenticity. A leader's self-awareness enhances their ability to connect with others in meaningful ways and make informed, reflective decisions. Thus, self-awareness is hypothesized as a significant component of authentic leadership.
H1a: Self-awareness (SA) is a significant component of authentic leadership.

Relational transparency (RT) reflects the leader's openness in presenting their true self to others (Rego et al., 2022). This includes honest expression, openness to feedback, and promoting truthful relationships. Leaders who exhibit relational transparency foster a climate of trust, which is a critical indicator of authentic leadership (Kempster et al., 2019). Hence, relational transparency is expected to be a significant part of the authentic leadership construct.
H1b: Relational transparency (RT) is a significant component of authentic leadership.

Balanced processing (BP) refers to objectively analysing all relevant information, including differing viewpoints, before making decisions (Long et al., 2024). Leaders who practice balanced processing are perceived as fair, unbiased, and thoughtful (Lynch et al., 2022). This dimension promotes inclusivity and ethical reasoning, both of which are central to authentic leadership.
H1c: Balanced processing (BP) is a significant component of authentic leadership.

Internalized moral perspective (IMP) involves self-regulation guided by internal moral standards and values, rather than external influences or pressures (Krettenauer & Stichter, 2023). Leaders who adhere to strong moral values are consistent in their behaviour and decisions, which reinforces their authenticity and integrity in the eyes of followers (Alavi, 2024). Therefore, internalized moral perspective is hypothesized to significantly shape the authentic leadership construct.
H1d: Internalized moral perspective (IMP) is a significant component of authentic leadership.

2.5 | Mediating Effect of Technological Diversity

In the digital era, technological diversity—the presence and use of a wide range of technologies, digital tools, and IT systems within organizations—has emerged as a key enabler of innovation and performance (Shah et al., 2024). Technological diversity not only facilitates knowledge sharing and collaboration but also provides employees with the resources and flexibility needed to explore creative ideas and solve problems innovatively. Authentic leadership, with its focus on openness, ethical behaviour, and inclusive decision-making, can play a significant role in fostering technological diversity. Leaders who are self-aware, transparent, and value diverse perspectives are more likely to support the adoption of a variety of technological solutions (Crook et al., 2021) and promote a culture that embraces digital experimentation. They empower employees to explore, utilize, and integrate new technologies in their work processes. As such, authentic leadership is expected to be positively associated with technological diversity within organizations.
H2: Authentic leadership is significantly and positively associated with technological diversity in the telecommunication sector in Pakistan.

Furthermore, technological diversity enhances employees' innovation by providing access to varied tools, platforms, and systems that enable experimentation, idea generation, and knowledge integration (Yin et al., 2024). When employees operate in technologically rich environments, they are more capable of applying novel combinations of resources to produce innovative outcomes. In this context, technological diversity acts as both a stimulus and a support system for innovation.

H3: Technological diversity is significantly and positively associated with employees' innovation in the telecommunication sector in Pakistan.

In addition to its direct effects, technological diversity may also serve as a mediating mechanism through which authentic leadership influences employee innovation. While authentic leadership creates the psychological safety and motivation needed for innovation, technological diversity provides the infrastructure and tools that make innovation possible (Park et al., 2025). Therefore, the presence of diverse technological resources may explain how and why authentic leadership leads to innovative outcomes among employees.

H4: Technological diversity significantly mediates the relationship between authentic leadership and employees' innovation in the telecommunication sector in Pakistan.

3 | METHODS

3.1 | Data Collection: Procedure and Sample

This research adopted a quantitative methodology using a cross-sectional design to explore the connections among authentic leadership, technological diversity, and employee innovation within Pakistan's telecommunication industry. The cross-sectional approach facilitated the gathering of data at one specific time, offering insights into how employees perceive leadership styles and innovation-related activities in their organizations. Data were collected from executive-level employees working in the telecommunication industry, as these individuals typically hold strategic responsibilities and are actively involved in decision-making processes related to innovation and technology. A drop-off and pick-up survey method were used for distributing the questionnaires. This approach involved personally delivering printed questionnaires to selected participants at their workplaces and retrieving them after an agreed duration. This method was chosen to increase the response rate, reduce non-response bias, and allow respondents adequate time to complete the survey.

To measure the constructs of interest—authentic leadership, technological diversity, and employees' innovation—a structured questionnaire was developed using standardized measurement items adapted from prior validated studies. A 7-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree") was employed to capture respondents' perceptions and attitudes toward the variables. A proportionate stratified random sampling technique was adopted to ensure a representative sample across Pakistan's major telecommunication companies: Jazz, Telenor, Ufone, and Zong. The stratification was based on the relative workforce size of each company, thereby ensuring that each organization's participation was proportional to its presence in the sector. This sampling method helped minimize bias and ensured broader generalizability of the results across the industry. The sample size was set at 379 respondents, calculated based on the recommendations of Sekaran and Bougie (2016), who suggest a minimum of 30 responses per variable for multivariate analysis. Anticipating a 25% response rate, a larger number of questionnaires were initially distributed to ensure that the final sample would meet the statistical requirements for structural equation modelling.

3.2 | Measurement of Variables

To examine the proposed research framework, all constructs in this study were measured using previously validated multi-item scales sourced from established literature. Authentic leadership was measured as a multidimensional construct consisting of four core components. Self-awareness was measured using 8 items adapted from Gumusluoglu and Ilsev (2009), reflecting the leader's awareness of personal strengths, weaknesses, and emotional responses. Relational transparency was also measured using 8 items, based on the works of Pieterse et al. (2010) and Krause (2004), capturing the leader's openness in communication and truthfulness in relationships. Balanced processing, which assesses a leader's ability to consider multiple perspectives before making decisions, was measured with 7 items derived from Spinelli (2006) and McMurray and Dorai (2003). Lastly, internalized moral perspective was measured using 6 items from Pieterse et al. (2010), reflecting ethical standards and value-driven leadership behaviour.

The mediating variable, technological diversity, was assessed with 8 items adopted from Avolio et al. (2004). These items measured the degree to which employees perceived a diversity of technological tools, platforms, and systems available in their work environment to support creativity and innovation. For employees' innovation, the construct was measured through 5 items from De Jong and Hartog (2010) and Dorenbosch et al. (2005). These measurement

items ensured comprehensive coverage of the constructs and provided a solid foundation for the analysis of the relationships among authentic leadership, technological diversity, and employees' innovation in Pakistan's telecommunication sector.

3.3 | Statistical Analysis

This study employed Structural Equation Modelling (SEM) using AMOS (Analysis of Moment Structures) software to analyse the collected data and examine the hypothesized relationships among the variables. The research was conducted in two main phases. In the first phase, Confirmatory Factor Analysis (CFA) was performed to evaluate the validity and reliability of the measurement model (Al-Fadhali, 2024). During this process, both convergent and discriminant validity, as well as construct reliability for each variable, were assessed. To ensure the robustness of the measurement model, key indicators such as factor loadings, Average Variance Extracted (AVE), Composite Reliability (CR), and Cronbach's Alpha were thoroughly examined. In the subsequent phase, the structural model was tested to analyse the hypothesized pathways among authentic leadership, technological diversity, and employee innovation. SEM facilitated the estimation of path coefficients, evaluation of the model's goodness-of-fit, and assessment of the statistical significance of both direct and indirect effects. Additionally, the mediating role of technological diversity between authentic leadership and employees' innovation was examined using bootstrapping techniques within AMOS to test the significance of indirect effects. This method provides more accurate confidence intervals for mediation effects, especially in models involving latent variables.

4 | RESULTS

4.1 | Demographic Assessment

The demographic characteristics of the respondents in this study are summarized in Table 1. The assessment includes key variables such as gender, age, marital status, education level, religion, and company affiliation. These components provide a comprehensive overview of the participants' background, ensuring diverse representation across different segments of the telecommunication sector in Pakistan. This diversity strengthens the generalizability of the findings and supports the reliability of the analysis by capturing varied perspectives from employees across four major companies: Jazz, Telenor, Ufone, and Zong.

Table 1
Demographic Assessment

	Characteristics	Number	Percentage
Gender	Male	196	54.9%
	Female	161	45.1%
Age	20 – 30	68	19.0%
	31 – 40	119	33.3%
	41 – 50	102	28.6%
	51 – 60	46	12.9%
	61 and above	22	6.2%
Marital status	Single	98	27.5%
	Married	207	58.0%
	Widow	34	9.5%
	Divorced	18	5.0%
Education	Diploma	34	9.5%
	Bachelor degree	89	24.9%
	Master	223	62.5%
	Doctorate	11	3.1%
Religion	Muslim	334	93.6%
	Christian	18	5.0%
	Others	5	1.4%
Company	Jazz	87	24.4%
	Telenor	96	26.9%
	Ufone	79	22.1%
	Zong	95	26.6%

4.2 | Normality Test

To evaluate the data distribution, a normality test was carried out by examining the skewness and kurtosis values for each variable. These statistical measures are essential for determining whether the dataset approximates a normal distribution, which is a crucial assumption for conducting multivariate techniques like Structural Equation Modeling (SEM). As presented in Table 2, the skewness and kurtosis results for key constructs—namely authentic leadership, technological diversity, and employees' innovation—were all within the acceptable threshold of ±3, in line with the guideline provided by Kline (2015). This confirms that the data reasonably follow a normal distribution and are therefore appropriate for parametric analysis.

Table 2
Descriptive Statistics

Constructs	Range	Mean	Std. Dev.	Skewness	Kurtosis
Self-awareness	1-7	5.87	0.35	0.012	0.075
Relational transparency	1-7	5.66	0.44	0.068	-0.538
Balanced processing	1-7	5.92	0.38	0.128	-0.277
Internalized moral perspective	1-7	5.24	0.51	-0.046	0.823
Technological diversity	1-7	5.73	0.48	0.194	0.883
Employee Innovation	1-7	5.51	0.54	0.359	-0.116

4.3 | Discriminant Validity

To evaluate discriminant validity, which reflects the degree to which different constructs are empirically distinct, this study utilized the Heterotrait-Monotrait Ratio (HTMT) of correlations—an established technique in Structural Equation Modeling (SEM). Following the guidelines proposed by Henseler et al. (2015), a cut-off value of 0.85 was adopted to assess whether the constructs in the model are sufficiently differentiated. As shown in Table 3, all HTMT values were below this recommended threshold, indicating that discriminant validity was successfully established. This result suggests that the constructs of authentic leadership, technological diversity, and employees' innovation are conceptually and statistically distinguishable within the scope of this research.

Table 3
HTMT Correlation

Constructs	1	2	3	4	5	6
Self-awareness	1					
Relational transparency	0.354	1				
Balanced processing	0.332	0.375	1			
Internalized moral perspective	0.263	0.368	0.389	1		
Technological diversity	0.443	0.315	0.297	0.382	1	
Employees' innovation	0.477	0.321	0.358	0.434	0.535	1

4.4 | Confirmatory Factor Analysis (CFA) Results

Confirmatory Factor Analysis (CFA) was conducted using AMOS software to ensure the validity of the measurement model. CFA facilitates the assessment of construct validity by evaluating how well the observed indicators represent their underlying latent constructs. In this study, convergent validity was assessed using two key measures: Construct Reliability (CR) and Average Variance Extracted (AVE). Items evaluating a certain concept are evaluated for internal consistency using CR; reliability is judged to be adequate when CR values are 0.60 or more (Bagozzi & Yi, 1988). In the meanwhile, AVE assesses how much of the variance attributable to error is explained by a concept. Fornell and Larcker (1981) state that a concept has excellent convergent validity if its AVE value is 0.50 or higher, which means it captures more than half of the variation of its indicators.

As shown in Table 4, every variable in the study met or surpassed the suggested thresholds for both CR and AVE, including the four elements of authentic leadership (self-awareness, relational transparency, balanced processing, and internalized moral perspective), technological diversity, and employee innovation. Strong internal reliability was confirmed by CR values over 0.60 for all constructs, and the constructs' capacity to explain the variation in their

respective indicators was confirmed by AVE values exceeding 0.50.

Table 4
AVE and CR Evaluation

Constructs	Items	Standardized Loading	CR	AVE
Self-awareness	SA_1	0.73	0.908	0.624
	SA_2	0.78		
	SA_3	0.75		
	SA_4	0.83		
	SA_5	0.88		
	SA_8	0.76		
Relational transparency	RT_1	0.82	0.912	0.634
	RT_2	0.86		
	RT_3	0.71		
	RT_4	0.79		
	RT_5	0.81		
	RT_6	0.78		
Balanced processing	BP_1	0.92	0.922	0.664
	BP_2	0.86		
	BP_3	0.84		
	BP_4	0.81		
	BP_5	0.73		
	BP_6	0.71		
Internalized moral perspective	IMP_1	0.74	0.908	0.622
	IMP_2	0.79		
	IMP_3	0.89		
	IMP_4	0.82		
	IMP_5	0.75		
	IMP_7	0.73		
Technological diversity	TD_1	0.84	0.937	0.715
	TD_2	0.76		
	TD_3	0.78		
	TD_4	0.87		
	TD_5	0.93		
	TD_6	0.88		
Employees' innovation	EI_1	0.74	0.899	0.642
	EI_2	0.76		
	EI_3	0.86		
	EI_4	0.72		
	EI_5	0.91		

4.5 | Hypothetical Results

To test the proposed relationships in the structural model, SEM was employed using standardized path estimates (Fan et al., 2016). The results of the hypothesis testing, including standardized estimates, Z-values, and p-values, are presented in Table 4.8.

Table 5
Testing Hypotheses Using Standardized Estimates

Hypothesized Path	Standardized Estimate	Z-Value	P- value	Result
H1a: SA→AL	0.34	4.367	0.000	Significant
H1b: RT →AL	0.38	4.883	0.000	Significant
H1c: BP →AL	0.29	3.935	0.000	Significant
H1d: IMP →AL	0.32	4.252	0.000	Significant
H1: AL →EI	0.26	3.761	0.000	Significant
H2: AL →TD	0.56	6.973	0.000	Significant
H3: TD →EI	0.61	7.248	0.000	Significant

The results provide empirical support for the suggested model, showing that all anticipated associations were statistically significant and in the expected positive direction. In particular, it was discovered that the four aspects of genuine leadership—internalized moral perspective (IMP), balanced processing (BP), relational transparency (RT), and self-awareness (SA)—all significantly contributed to the concept of authentic leadership as a whole. The standardized estimates for these paths were as follows: "H1a (SA → AL): $\beta = 0.34$, $Z = 4.367$, ***$p < 0.001$; H1b (RT → AL): $\beta = 0.38$, $Z = 4.883$, ***$p < 0.001$; "H1c (BP → AL): $\beta = 0.29$, $Z = 3.935$, ***$p < 0.001$; "H1d (IMP → AL): $\beta = 0.32$, $Z = 4.252$, ***$p < 0.001$". These results confirm that all four sub-dimensions significantly and positively influence the development of authentic leadership within the context of Pakistan's telecommunication sector. Moreover, the study also found support for the hypothesized relationship between authentic leadership and employees' innovation: "H1 (AL → EI): $\beta = 0.26$, $Z = 3.761$, ***$p < 0.001$". This indicates that employees are more likely to engage in innovative behaviors when they are led by authentic leaders who foster trust, openness, and ethical conduct. Regarding the role of technological diversity, the results demonstrated a strong and significant positive association between authentic leadership and technological diversity: "H2 (AL → TD): $\beta = 0.56$, $Z = 6.973$, ***$p < 0.001$". This suggests that authentic leaders are more inclined to adopt and promote diverse technological tools and systems within the organization. Furthermore, technological diversity was also found to have a significant positive influence on employees' innovation: "H3 (TD → EI): $\beta = 0.61$, $Z = 7.248$, ***$p < 0.001$". This result underscores the importance of a technologically rich environment in facilitating innovative practices among employees.

4.6 | Mediation Analysis

To evaluate the mediating role of technological diversity in the relationship between authentic leadership and employees' innovation, a bootstrapping procedure was conducted using SEM in AMOS. Bootstrapping is a non-parametric resampling technique that provides robust estimates of indirect effects and is widely recommended for mediation analysis, especially in models involving latent variables (He et al., 2025). The results of the mediation analysis are presented in Table 6. The findings show that both the indirect effect and the direct effect are statistically significant. The indirect effect of authentic leadership on employees' innovation through technological diversity was found to be 0.351, with a bootstrapping p-value of 0.000, indicating a highly significant result. Additionally, the direct effect of authentic leadership on employees' innovation remained significant (0.273, p = 0.001), even after accounting for the mediating variable.

Table 6
Bootstrapping Result

Variables	Indirect Effect	Direct Effect
Effect	.351	.273
P-Value	.000	.001
Result	Significant. The partial mediation occurs	Significant

These results confirm the presence of partial mediation, suggesting that technological diversity partially explains how authentic leadership contributes to enhanced employee innovation. In other words, authentic leaders not only influence innovation directly through their behaviors and leadership style but also indirectly by fostering a technologically diverse environment that supports employees' innovation. The support for Hypothesis 4 highlights the strategic importance of integrating leadership practices with technological infrastructure to drive innovation within organizations. The partial mediation implies that while authentic leadership alone can stimulate innovation, its effect is significantly amplified when accompanied by technological diversity in the workplace.

5 | DISCUSSION

This study aimed to examine the impact of authentic leadership on employees' innovation, with technological diversity acting as a mediating variable in the context of Pakistan's telecommunication sector. The findings from SEM and bootstrapping analysis provide strong empirical support for the proposed research model and hypotheses. The results confirmed that all four dimensions of authentic leadership—self-awareness (SA), relational transparency (RT), balanced processing (BP), and internalized moral perspective (IMP)—are significant contributors to the overall construct of authentic leadership. This finding supports existing literature that positions authentic leadership as a multidimensional construct rooted in personal integrity, transparency, and ethical decision-making (Walumbwa

et al., 2008). These leadership traits appear particularly influential in dynamic sectors like telecommunications, where strategic thinking and employee engagement are crucial for competitive advantage. Leaders who demonstrate these qualities help create a trusting and empowering environment that nurtures innovation. The study also found that authentic leadership has a significant positive effect on employees' innovation (H1). This indicates that when employees perceive their leaders as authentic—open, self-aware, morally grounded, and fair—they are more likely to engage in innovative behaviours such as idea generation, championing, and implementation. This aligns with prior research suggesting that authentic leaders promote psychological safety, trust, and open communication, which are essential conditions for innovation to flourish in organizations (Rego et al., 2012; Avolio & Gardner, 2005). Further, authentic leadership was found to have a strong positive association with technological diversity (H2). This suggests that authentic leaders not only inspire trust and openness but are also more likely to embrace and promote a variety of technological tools and digital systems. Such leaders recognize the importance of technology in driving organizational performance and fostering an innovative climate. According to Durrah et al. (2024), technological diversity acts as a critical organizational resource that broadens the range of innovation opportunities available to employees. The study also confirmed that technological diversity significantly enhances employees' innovation (H3). A technologically diverse environment provides employees with flexible tools, access to information, and platforms for collaboration—all of which support the development and implementation of new ideas. The findings of Mohammadi et al. (2017) also emphasizes the importance of investing in varied and up-to-date technological infrastructures to stimulate and sustain innovation within organizations.

Most notably, the mediation analysis revealed that technological diversity partially mediates the relationship between authentic leadership and employees' innovation (H4). This finding indicates that while authentic leadership directly fosters innovation, its influence is amplified through the presence of technological diversity. Authentic leaders create the enabling environment, but it is the access to and variety of technology that transforms leadership potential into innovative outcomes. The partial mediation also highlights that leadership and technology are interdependent levers—both necessary, yet individually impactful—when building an innovation-driven organizational culture. Overall, these findings reinforce the theoretical premise that authentic leadership is a foundational driver of innovation, especially when supported by a robust technological infrastructure. In the context of Pakistan's fast-evolving telecommunication sector, where agility and innovation are essential for survival and growth, the integration of ethical leadership and technological enablement emerges as a powerful strategy. This study thus contributes to the literature by empirically validating the mediating role of technological diversity, offering insights into how leadership styles and organizational resources interact to shape innovative performance.

6 | IMPLICATIONS OF THE STUDY

6.1 | Theoretical Implications

The study contributes to the theoretical development of authentic leadership theory by empirically validating the multidimensional structure comprising self-awareness, relational transparency, balanced processing, and internalized moral perspective. It extends the application of authentic leadership into the domain of innovation performance, an area that has remained relatively underexplored in emerging economies, especially in South Asia. Moreover, the study enriches leadership theory by introducing technological diversity as a novel mediating construct, demonstrating how leadership influences can be enhanced or channelled through technological systems to foster innovation. This highlights the interplay between human and technological factors in shaping organizational outcomes.

6.2 | Practical and Managerial Implications

From a managerial perspective, the findings underscore the critical importance of cultivating authentic leadership behaviors within the organization. Leaders who are self-aware, transparent, morally guided, and open to diverse perspectives create a work culture that supports creativity, experimentation, and idea sharing. Therefore, organizations should invest in leadership development programs that emphasize ethical conduct, emotional intelligence, and self-reflection to nurture authentic leaders. The study also reveals the strategic role of technological diversity in enabling innovation. Telecommunication companies should ensure that employees have access to a wide range of digital tools, platforms, and collaborative technologies. Investment in diverse technologies not only improves operational efficiency but also creates an environment that supports creative thinking and rapid problem-solving. Managers must therefore take an integrative approach, aligning leadership practices with digital

transformation strategies to boost employee performance and innovation outcomes.

7 | LIMITATIONS AND RECOMMENDATIONS

Despite offering valuable insights into the relationship between authentic leadership, technological diversity, and employees' innovation within Pakistan's telecommunication sector, this study is not without limitations. First, the use of a cross-sectional research design restricts the ability to infer causal relationships between the constructs. The observed associations provide a snapshot in time and do not account for changes or developments over time. Future research should consider employing longitudinal designs to better understand how authentic leadership and technological diversity influence innovation performance over extended periods. Second, the study was conducted solely within the telecommunication sector of Pakistan, which may limit the generalizability of the findings to other industries or countries. Leadership behaviours and technological environments vary across sectors and cultural contexts; thus, future studies should replicate this research in different organizational settings and geographic regions to assess the broader applicability of the results. Third, the data were collected using self-reported questionnaires, which raises the possibility of common method bias and social desirability effects. Although efforts were made to mitigate this—such as ensuring anonymity and using established measurement scales—biases may still influence responses. Future research should incorporate multi-source data (e.g., supervisor evaluations or objective innovation metrics) to improve the validity and reliability of the findings. Fourth, the study focused on technological diversity as the sole mediating variable, yet other factors such as organizational learning climate, psychological empowerment, or employee engagement may also play important mediating or moderating roles. Including these variables in future studies could provide a more comprehensive understanding of the mechanisms that link leadership to innovation.

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