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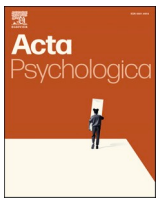

Humble leadership and creativity in SMEs: A pathway to achieve SDG 8 and SDG 9 in the industry 4.0 era

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ABSTRACT

The research explores how SME employee creativity develops under humble leadership (HL) in the context of Industry 4.0. This research applies the Job Demands-Resources theory to study direct HL effects on creativity and examine indirect relationships through employee vitality and peer support as well as the moderating impact of polychronicity. The research data shows that HL creates creativity directly and indirectly through employee vitality and peer support among 418 UK-based SME employees and supervisors, as analyzed through structural equation modeling. Moreover, the study demonstrates these effects increase when employees show polychronicity. The effects become stronger for people who possess effective multitasking abilities. The research presents practical guidelines to SME leaders demonstrating that leadership approaches based on employee welfare, teamwork,

1. Introduction

In the United Kingdom, over 99 % of businesses are SMEs, yet nearly 60 % of these enterprises report significant challenges in achieving sustainable growth due to resource constraints and rapid technological advancements (Roper et al., 2024). For many SMEs, sustainability is not simply an operational goal but a critical imperative for survival in today's dynamic business environment. In this respect, employee creativity has emerged as a cornerstone for organizational success in the dynamic business landscape of Industry 4.0 (I4.0), where digital transformation and sustainability are key drivers of competitive advantage (Gajdzik & Wolniak, 2022). Defined as the ability of employees to generate novel and useful ideas for solving problems, enhancing processes, and driving innovation, creativity is increasingly recognized as a vital resource for organizations striving to achieve sustainable growth (Shin et al., 2017). Employee creativity is a cost-effective alternative to traditional innovation methods that require extensive infrastructure or huge financial investments and instead harness human capital to deliver meaningful, context-specific solutions (Anderson et al., 2014). For instance, Google's Gmail and 3 M's Post-it Notes are iconic examples of employees' creativity leading to innovation (Ahmad, Han, & Kim, 2024). Employee creativity is a crucial factor in small and medium-sized enterprises (SMEs), which are important to global economies but are often resource-constrained (Mahmood et al., 2021). Due to larger organizations' lack of expansive R&D budgets, SMEs are forced to use their employees' ingenuity and adaptability to solve their operational problems and exploit the emerging opportunities (Costa et al., 2023). Employees have a deep understanding of their organization's processes, problems, and client needs, enabling them to create practical, contextually appropriate solutions (Ahmad et al., 2022). For example, a small furniture manufacturer may want an employee's creative input into optimizing its production layout and cutting costs without investing in costly technological upgrades. Such idiosyncratic solutions not only ameliorate operational efficiency but also make organizations agile and resilient in a fast-changing market environment (Guo et al., 2021). Employee creativity, in the context of Industry 4.0 where digital technologies such as artificial intelligence (AI) and the Internet of Things (IoT) are transforming business operations, is a route through which

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SMEs can embed sustainability into the business models (Malik et al., 2021). Creativity supports the United Nations' Sustainable Development Goals (SDGs) of Goal 8 (inclusive and sustainable economic growth) and Goal 12 (responsible consumption and production). For instance, creative employees in SMEs can utilize their knowledge to propose sustainable practices, e.g., IoT enabled systems to monitor energy consumption or redesigning packaging to reduce waste that contributes both to environmental and economic sustainability (Narkhede, Mahajan, et al., 2024). These are creative, technology driven solutions that are cost effective and match the general goals of the Industry 4.0 revolution to realize transformative sustainability.

Leadership is critical to employee creativity, as leaders play an important role in shaping the work environment, employee motivation, and the resources they have to contribute to creativity (Mumford et al., 2002). Effective leadership nurtures a situation where employees feel free to be creative with new ideas, take some chances, and question old assumptions without fear of failure (Shalley & Gilson, 2004). Leadership shapes organizational culture and serves as a catalyst for creativity by providing vision, support, and recognition. The above context clearly indicates the seminal importance of leadership in achieving a range of organizational objectives. Mainly through leadership organizations achieve their path toward sustainability. Research has extensively studied transformational and sustainable leadership approaches (Liu et al., 2024; Peng et al., 2022), yet the precise effects of HL (HL) in the SME environment need further examination. The main features of HL differ from directive-oriented leadership styles through its emphasis on employee recognition and openness and its continuous learning approach. This leadership approach is specifically suitable for SMEs since their leaders need to leverage internal resources with innovative, cost-effective solutions to address their constraints. Hence, this research exclusively examines the HL leadership style because of its central role in this investigation. The Job Demands-Resources (JD-R) theory serves as our basis for understanding how HL advances employee creativity through increased employee vitality and peer support. SMEs need to comprehend how Holistic Leadership creates supportive and energetic work environments since I4.0 brings unanticipated challenges along with opportunities for these companies.HLHL.

This study aims to study the relationship between HL and employee creativity and to find out how this relationship works. In particular, employee vitality and peer support are introduced as mediating mechanisms, while polychronicity is proposed as a moderating mechanism. We propose employee vitality (the energy and enthusiasm employees bring to their work) as a mediator because humble leaders are likely to energize their team and elicit the positive affective states needed for creativity (Carmeli & Spreitzer, 2009). Additionally, the mediating role of peer support is posited, as HL fosters collaborative relations and a supportive network that enables employees (Salamon et al., 2022) to feel comfortable sharing and refining creative ideas. As moderators, we introduce polychronicity, the tendency to multitask and handle several responsibilities at the same time, as SMEs often ask employees to do things at the same time. The humility of leaders may facilitate channeling highly polychronic employees' multitasking tendencies into creative solutions (Lindquist & Kaufman-Scarborough, 2007). Understanding the complexity of the HL–creativity dynamic requires acknowledgment of the dual mediating and moderating roles, especially in SMEs, where resource constraints call for innovative solutions that are also cost-effective. This study adds to the nuanced understanding of how leadership can enable employee creativity that aligns with the goals of Industry 4.0 and the SDGs through exploring these variables.

This study focuses on the SME sector in the United Kingdom (UK), which has over 99 % of all UK businesses and serves as the backbone of the economy (Hutton & Murray, 2024). On the other hand, UK SMEs remain constrained by limited resources, restricted access to innovation infrastructure, and an ever more volatile market environment marked by economic uncertainties, including Brexit and COVID-19 (Clark, 2024). These challenges prevent SMEs from being competitive and growing, so it is necessary to find creative solutions to fit into the SMEs' special contexts. These problems offer a potentially promising avenue of solution: employee creativity allows SMEs to innovate in a cost-effective manner and adapt to continuously changing market needs. Deep organizational knowledge of SME employees can be leveraged to follow creative, resource-efficient strategies to overcome barriers, be resilient, and align to Industry 4.0 and global sustainability goals.

Despite its potential, the intersection of HL and employee creativity in SMEs has received limited scholarly attention. Recent studies have predominantly examined the impact of transformational and sustainable leadership on innovation, leaving a critical gap regarding the sophisticated role of HL. By addressing this gap and incorporating current evidence (Al Wali et al., 2022; Iqbal & Ahmad, 2021), our research aims to provide new insights into how HL uniquely contributes to sustainable business practices. Although the literature discussing the importance of employee creativity to organizational success has been growing, many important gaps remain unexplored, particularly in terms of the effect of leadership styles, mediating mechanisms, and contextual factors. Second, while there are many studies that examine the leadership and creativity relationship (Hughes et al., 2018; Lee et al., 2020), the effect of HL on employee creativity, in particular within SMEs is relatively under-researched. Unlike other leadership styles, HL is particularly well suited to promote the openness, collaboration, and psychological safety that are key drivers of creativity (Owens & Hekman, 2012), and yet its use in resource-constrained settings such as SMEs has not been adequately addressed. Third, the dual mediating mechanisms of employee vitality and peer support in the HL–creativity relationship have not been studied. Identified as important predictors of workplace outcomes, vitality, and peer support have not been studied comprehensively in their combined influence as mediators in this context (Afshar Jahanshahi et al., 2019; Wei Tian et al., 2016). This gap is critical because vitality increases employees' energy and enthusiasm for creative problem-solving, and peer support creates a collaborative milieu that facilitates idea-sharing and innovation. Additionally, the moderating effect of polychronicity is not addressed since SMEs typically employ multitasking and flexibility to surmount the constraints of their resources and the volatility of their environment (Fu et al., 2022).

The focus on the UK's SME sector is particularly significant from a contextual perspective. However, the existing literature is largely concentrated in large organizations or non-western contexts, making it difficult to generalize, as UK SMEs face challenges such as resource scarcity, market volatility, and lack of access to innovation infrastructure. However, studies investigating this dynamic in UK SMEs are sparse, and employee creativity, backed by HL, can provide cost-effective and impactful solutions to these challenges. Additionally, the majority of SMEs do not succeed beyond their first few years of operation due to their inability to change and evolve (Hutton & Murray, 2024). Finally, the study deals with the critical SDGs: SDG 8 (Decent Work and Economic Growth) and SDG 12 (Responsible Consumption and Production). Achieving these SDGs depends on the involvement of SMEs who promote inclusive growth and reduce resource inefficiencies. However, there is a paucity of work regarding how creativity can be integrated as a strategic enabler to achieve these goals. Filling these gaps not only contributes to theory but also to actionable knowledge to the benefit of SMEs in flourishing in the face of global economic and environmental challenges.

This paper will continue with the following organization. Our literature review, together with the theoretical framework, is presented in Section 2. Section 3 details the research methodology which includes information about sample selection together with measurement instruments and data analysis steps. This paper's empirical findings appear in Section 4 while Section 5 demonstrates the theoretical and practical effects of our research results. The paper ends with recommendations for SME leaders along with proposals for future research investigations.

2. Literature review and theoretical underpinning

Leadership significantly influences employee creativity by shaping workplace environments that either enhance or inhibit innovation. Leadership styles such as transformational, servant, and authentic leadership have been extensively studied due to their proven capacity to enhance employee creativity (Ahmad, Samad, & Han, 2024; Ahmad, Scholz, et al., 2021). However, HL, characterized by openness, acknowledging mistakes, actively soliciting feedback, and appreciating employee strengths (Xue et al., 2024), remains comparatively underexplored, particularly within the SME context. This gap is significant because SMEs, unlike larger firms, rely heavily on internally driven, cost-effective innovation due to resource constraints, and HL uniquely facilitates such innovation by leveraging internal resources effectively.

Effective leadership not only sets the tone for workplace culture but also influences how employees perceive and engage with their work environment (Amabile & Khaire, 2008). Leaders who create psychologically safe spaces, encourage open communication, and reward innovative behaviors are more likely to inspire employees to generate novel and useful ideas (Mumford et al., 2002). Research has consistently demonstrated that leadership styles such as transformational, servant, and authentic leadership positively impact employee creativity by fostering an environment conducive to exploration, risk-taking, and collaboration (Zhou & Shalley, 2011). Such leadership influences employees' intrinsic motivation, a critical driver of creativity, by instilling a sense of purpose and aligning employees' goals with organizational objectives (Ryan & Deci, 2000). As a leadership style, HL has been found to be particularly well suited to creating employee creativity in dynamic and resource constrained settings, as studied in this study. Humble leaders, defined by their willingness to admit mistakes, give credit where credit is due, and to solicit feedback, create a milieu that empowers employees to feel valued and to think innovatively (Owens & Hekman, 2012). An active barrier remover to creativity, removing fear of judgment or failure and nurturing the psychological safety needed for employees to explore and implement new ideas (Zheng & Ahmed, 2024). In SMEs, HLHL is particularly relevant as employee creativity can resolve operational inefficiency and create competitive advantage through cost effective and context specific solutions (Tariq et al., 2023). Humble leaders foster openness and inclusivity, which enables employees to bring out their knowledge and insights to make new and innovative solutions that fit within the organization's goals.

While SMEs globally share resource constraints, research indicates regional differences in leadership and creativity dynamics due to varying cultural and institutional contexts. For instance, SMEs in emerging economies face additional challenges related to institutional support and technological infrastructure (Ahmad, Mahmood, et al., 2021; Zou et al., 2021). Asian SMEs often experience hierarchical leadership structures (Muenjohn et al., 2021), which might reduce the perceived accessibility or acceptability of HL compared to SMEs in Western regions like the UK, where flatter and inclusive leadership approaches are increasingly common (Wang & Poutziouris, 2010). Furthermore, recent research highlights varying impacts of Industry 4.0 across global SMEs, underscoring differences in resource allocation, adoption barriers, and management styles, directly impacting employee creativity and sustainable practices (!!! INVALID CITATION !!!, n.d.).

The present study offers a robust theoretical framework based on the Job Demands-Resources (JD-R) Theory (Bakker et al., 2014), in order to understand the relationship between HL and employee creativity. According to this theory job resources (e.g., supportive leadership, collaborative peer networks, and positive psychological states) enhance motivation and performance by increasing engagement and decreasing strain (Bakker et al., 2007). HL serves as a key job resource that allows employees to direct their energy and enthusiasm into innovative problem-solving. Humble leaders promote an environment that is packed with resources, which in turn stimulates employees' intrinsic motivation and will allow them to engage in creative behavior (Schaufeli, 2015; Yao et al., 2021). Further, leadership is explained by JD-R theory as the factor that mitigates the negative impact of job demands, multitasking, and resource constraints to maintain creativity for SMEs by providing support and fostering resilience.

H1. HL is positively associated with employee creativity.

Leadership significantly influences employee vitality, which is defined as the positive energy and enthusiasm individuals bring to their work (Azila-Gbettor et al., 2024). Vitality is a cornerstone of employee well-being and performance, enabling sustained focus, resilience, and engagement in their roles (Ryan & Frederick, 1997). Leaders play a critical role in fostering vitality by creating environments where employees feel valued and empowered (Tummers et al., 2018). HL, characterized by openness, empathy, and recognition of others, is uniquely effective in enhancing vitality. By seeking feedback, acknowledging contributions, and addressing concerns, humble leaders build trust and motivation that energize employees (Funck, 2015). In SMEs, where multitasking and resource constraints often lead to employee strain, HL mitigates these challenges by fostering collaboration and providing the recognition necessary to replenish vitality. Vitality, in turn, is a driving force behind employee creativity (Azila-Gbettor et al., 2024). Energized and enthusiastic employees are more likely to engage in cognitive and behavioral processes necessary for generating novel and useful ideas (Op den Kamp et al., 2023). The positive effect associated with vitality enhances intrinsic motivation, which is essential for creativity, enabling employees to explore innovative solutions, take calculated risks, and overcome challenges. Vitality, however, is especially crucial in SMEs, where such organizations areover-reliant on the ingenuity of their workforce to cope with operational inefficiencies and changing markets (Chong & Zainal, 2024). For instance, an energized employee driven by a humble leader could suggest innovative cost-saving strategies or process improvement that will directly lead to organizational success. The alignment of vitality and creativity is fundamental to the creation of meaningful innovation in resource-constrained settings.

Vitality is viewed as the mechanism by which HL relates to employee creativity using the JD-R theory. While motivation and engagement channeled into vitality are often the foundation of a healthy workplace, as a primary job resource, HL also decreases workplace strain. This personal resource allows employees to deploy their energy in creative tasks (Park et al., 2021). This interaction is especially important in SMEs, where the absence of extrinsic resources is compensated by intrinsic employee energy. In this manner, the vitality mediates the relationship between HL and creativity in an indirect way by promoting an environment in which energy and motivation are perpetually recharged and utilized.

H2. HL is positively associated with employee vitality.

H3. Employee vitality is positively associated with employee creativity.

H4. Employee vitality mediates the relationship between HL and employee creativity.

Leadership styles have a great impact on the dynamics of the workplace, i.e., how employees interact, collaborate, and innovate. Peer support, which is the informational, emotional, and practical support colleagues provide to each other, is an important social resource for enhancing employee creativity(Mead et al., 2001). Leaders, especially leaders with humility, are critical to creating a culture within which peer support can thrive. It encourages collaboration by Humbly Leaders valuing inclusiveness in a holistic manner, cultivating an open, communicative environment, and celebrating the work of all workers (Owens & Hekman, 2012). Leadership of this nature promotes a team culture that breaks down silos and allows employees to feel comfortable reaching out for and giving support (Chu et al., 2022). Humble leaders in SMEs acknowledge the need for employees to rely on their peers for guidance, feedback, and encouragement to reinforce a supportive

network, which is critical in dealing with challenges as resource limitation heightens the need for teamwork. Peer support directly impacts employee creativity because peer-provided social and cognitive resources are necessary for idea generation and refinement (Zaitouni & Ouakouak, 2018). Supportive colleagues who serve as sounding boards for the testing of new ideas, honing the solution or helping get over the hurdle of implementation (Ghaleb & Piaralal, 2024). It builds confidence among employees to undertake the creative process by sharing knowledge and constructive feedback with other trusted people in supportive peer networks. For SMEs, peer support is especially valuable because employees can tap into collective expertise to create cost effective solutions that fit their own organizational challenges. For example, in SME, with a collaborative team environment where people share ideas, innovation in product development or operational efficiency is possible without heavy investment from outside.

The effect of HL on employee creativity is mediated by peer support, strongly suggesting the need for social dynamics in the workplace. Robust peer networks are created by humble leaders who foster trust, encourage cooperation, and decrease interpersonal competition (Kim & Baik, 2015). In turn, these become productive peer networks that serve as means to creative collaboration, closing the gap between leadership influence and employee innovation. In the SME context, where external support systems typically have limited supply, peer support as an internal mechanism contributes to creativity through leadership. This context aligns with the JD-R as HL is a job resource that produces peer support, a critical social resource for driving employee creativity. The interaction between leadership and peer support is synergistic, suggesting that SMEs can maximize internal resources to promote sustainable innovation and respond to changing market demands.

H5. HL is positively associated with peer support.

H6. Peer support is positively associated with employee creativity.

H7. Peer support mediates the relationship between HL and employee creativity.

An individual's preference for carrying out multiple tasks simultaneously is called polychronicity, which is important in determining workplace outcomes, especially in dynamic and resource-constrained environments (Kirchberg et al., 2015). High polychronicity employees can switch between different responsibilities, cope with shifting demands, and juggle competing priorities, which are all especially important for SMEs in which multitasking is often required (Agnihotri & Bhattacharya, 2022). In leadership and workplace dynamics, polychronicity determines how employees respond to and benefit from their leaders' behaviors on pathways such as vitality and peer support. The practice of HL fosters the workplace climate for employee vitality that reduces the strain at the workplace, increases motivation, and builds empowerment (Azila-Gbettor et al., 2024). Employees with high polychronicity are in a better position to take advantage of these benefits. Employees with high polychronicity tendencies naturally excel at navigating complex, simultaneous tasks and are more likely to report increased vitality in an empowering, supportive, HL framework (Wu et al., 2020). This amplified vitality enables them to put their energy to use innovatively and creatively, solving problems that contribute to the organization (Wu et al., 2020).

Polychronicity also moderates the relationship between HL and peer support. Humble leaders foster collaboration, communication, and mutual respect among team members. In such environments, employees with high polychronicity will tend to excel as they have the aptitude to handle multiple tasks at a time and the capability to deal with a range of relationships that help them to actively participate and contribute to peer networks (Waheed et al., 2021). It improves the quality and frequency of peer interaction, allowing the exchange of ideas and the development of creative ways to solve problems (Waheed et al., 2021). This moderation affect is very important in SMEs, where resources are limited and effective collaboration is essential. As such, polychronicity increases the routes by which HL impacts vitality and peer support, therefore increasing their effect on employee creativity. This study hypothesizes:

H8a. Polychronicity moderates the relationship between HL and employee vitality, such that the relationship is stronger for employees with higher polychronicity.

H8b. Polychronicity moderates the relationship between HL and peer support, such that the relationship is stronger for employees with higher polychronicity.

In a nutshell, this study aims to address critical gaps by explicitly focusing on the unique role of HL within SMEs. Despite considerable attention given to other leadership styles, HL is uniquely suited to SMEs as it fosters employee psychological safety, openness, and collaboration, which are vital for innovation in resource-limited environments. Previous studies (Tariq et al., 2023; Zheng & Ahmed, 2024) acknowledged the importance of HL, but the mediating mechanisms linking HL to employee creativity remain unclear, particularly in SMEs where resource limitations amplify the role of leadership behaviors. Moreover, building on the JD-R framework, we argue that HL serves as a vital job resource, enhancing employee creativity through two distinct but complementary pathways: employee vitality and peer support (Bakker & de Vries, 2021). JD-R theory posits that job resources, such as supportive leadership and collaborative networks, bolster employees' motivation and creativity by fostering positive psychological states and reducing workplace strain. Specifically, HL encourages employee vitality and positive affective energy that fuels innovation while simultaneously building collaborative peer networks, enabling idea sharing and refinement (Ghaleb & Piaralal, 2024; Op den Kamp et al., 2023). Furthermore, considering SMEs' reliance on multitasking, this study introduces polychronicity as a moderator. Polychronic employees, who naturally prefer and thrive in multitasking scenarios, likely benefit more from the positive effects of HL on employee vitality and peer support, ultimately enhancing creativity (Agnihotri & Bhattacharya, 2022). For more clarity of the readers, we present a summary of past literature in the Table 1 below.

3. Methods

3.1. Participants and data collection procedure

Participants for this study were employees and supervisors working in SMEs in three major cities of the United Kingdom: Manchester, London, and Birmingham. These cities were selected because they have a high density of SMEs and contribute a large proportion of the UK economy across a wide variety of industries and organizational settings. In particular, the selection of Manchester, London, and Birmingham was based on both their high SME density and the diverse industrial profiles represented in these urban centers. These cities are economic powerhouses within the United Kingdom, with each hosting a broad spectrum of industries, ranging from manufacturing and technology to retail and services. This strategic choice was intended to ensure that the sample would capture the heterogeneity of the SME sector and, consequently, enhance the generalizability of our findings. A staggered approach to data collection was implemented in this study, meaning that data were collected in three separate waves over a two-month period. This approach involves distributing and collecting questionnaires sequentially rather than simultaneously, which helps to minimize temporal biases and allows for a more flexible and manageable survey administration process (Chen et al., 2022; Fu et al., 2023; Liu et al., 2023). Using this method ensured that respondents had ample time to complete the questionnaire, thereby enhancing response quality and reducing potential fatigue effects. This study followed ethical guidelines of the American Psychological Association (APA). All participation was voluntary, and all respondents were informed of the purposes of the

Table 1
Summary of Key Leadership-Creativity Studies.

Reference	Key Contributions & Findings	Identified Gap / Relevance to Current Study
Owens and Hekman (2012)	Established a foundational understanding of humble leadership (HL), highlighting behaviors such as openness, acknowledgment of mistakes, and valuing employees' contributions.	Groundbreaking in conceptualizing HL, but did not specifically focus on SMEs or the mediating mechanisms (e.g., vitality, peer support). The current study applies these concepts to resource-limited SME settings.
Kim and Baik (2015)	Showed that supportive leadership fosters a culture in which employees feel safe to propose novel ideas, enhancing creativity.	Provides evidence of cultural sophistication, relevant for comparing leadership approaches in different regions. Highlights supportive leadership's role but lacks focus on humility in SMEs.
Carmeli and Spreitzer (2009)	Demonstrated that employees' sense of vitality is crucial for innovation, as energized employees engage more readily in creative tasks.	Emphasizes vitality's significance for creativity but does not examine the specific effect of HL. Current study integrates HL and vitality to explain creativity in SMEs.
Tariq et al. (2023)	Found that humble leadership enhances employees' innovative behaviors and creative performance. Cultural context played a mediating role in how employees responded to humble leaders.	Establishes HL as pivotal for fostering creativity, but lacks clarity on additional mediators such as employee vitality and peer support. Our research extends these insights in the UK SME context.
Zheng and Ahmed (2024)	Showed that HL boosts team members' engagement and creativity, with leadership style moderated by cultural factors such as traditionality.	Reinforces the effectiveness of HL for creativity, yet limited to Chinese cultural settings. The current study explores UK-based SMEs and probes mediating mechanisms (vitality, peer support) and polychronicity.
Fu et al. (2022)	Demonstrated that employees high in polychronicity excel in psychologically safe, supportive environments, leading to enhanced creative behaviors.	Establishes polychronicity's relevance; our study expands on this by examining how HL and polychronicity interact to influence creativity in SME contexts that demand multitasking.
Ghaleb and Piaralal (2024)	Highlighted that robust peer networks and emotional support systems facilitate knowledge sharing, enabling employees to refine innovative solutions.	Underlines the critical role of peer support in creativity. We incorporate peer support as a mediator, further investigating how HL fosters collaborative networks that enhance innovative capacity in SMEs.
Narkhede, Dohale, and Mahajan (2024)	Found that I4.0 tools can strain SMEs lacking robust infrastructure, potentially hindering sustainable development and innovation capacity.	Illustrates how technology adoption alone does not guarantee creativity; leadership style is vital to navigate resource constraints. The current study shows how HL can offset such strain by promoting collaborative, innovation-friendly workplace conditions.
Guo et al. (2021)	Showed how giving autonomy to employees catalyzes creativity, especially when leaders support open dialogues and resource-sharing initiatives.	Suggests that leadership plays a central role in fostering autonomy and trust. Our research merges this concept with HL, demonstrating how humble leaders can empower employees via vitality and peer support, thus bridging autonomy and creativity in SMEs.

research and the confidentiality of their responses (Ahmad, Ahmad, & Siddique, 2023). All participants gave signed informed consent. Personal or identifying information was also not collected, making the participant anonymous (Deng et al., 2022; Guan et al., 2023). The institutional review board ethically approved the commencement of the data collection process.

To determine the minimum sample size required for our study, we conducted a G*Power analysis (Faul et al., 2007). G*Power is a statistical tool commonly used in social sciences to perform power analysis, which helps ensure that the study is sufficiently powered to detect medium effect sizes at a 95 % confidence level. Based on the analysis, a sample size of approximately 400 was recommended. This calculation was essential for validating our sample's adequacy, thereby reinforcing our empirical findings' robustness. Given the low response rates typically associated with survey research, we started with 700 questionnaires in order to ensure we would have a valid sample size in the vicinity of this recommendation. Of the 700 distributed questionnaires, 442 responses were received. We then screened for inaccuracies (e.g., incomplete responses, repeated answers across multiple scales, or inconsistent patterns) and found 418 valid responses. We worked through a careful validation process to ensure that the dataset was valid for analysis. The socio-demographic profile of the respondents is presented below in Table 2. To this end, our sample's industry breakdown was carefully compared to figures reported in national SME statistics. For instance, UK government reports, such as those from the Office for National Statistics (ONS) and the Department for Business, Energy and Industrial Strategy (BEIS), indicate that SMEs in the UK predominantly operate in the services and retail sectors, followed by manufacturing and technology, with a smaller proportion falling into miscellaneous categories. In our sample, the distribution, Manufacturing: 20.3 %, Services: 31.6 %, Retail: 23 %, Technology: 17 %, Other: 8.1 %, closely mirrors these national trends. Specifically, national data suggest that the service and retail sectors account for a significant majority of UK SMEs, which is reflected in our sample's 31.6 % and 23 % representations, respectively. Similarly, the manufacturing and technology figures in our sample are consistent with industry analyses, where manufacturing SMEs typically represent

Table 2
Socio-demographic profile of respondents.

Category	Frequency (n = 418)	Percentage (%)
Gender		
Male	236	56.5
Female	182	43.5
Age		
Under 25	54	12.9
25–34	168	40.2
35–44	121	28.9
45–54	53	12.7
55 and above	22	5.3
Position		
Employee	298	71.3
Supervisor/Manager	120	28.7
Industry Sector		
Manufacturing	85	20.3
Services	132	31.6
Retail	96	23
Technology	71	17
Other	34	8.1
Years of Experience		
Less than 1 year	26	6.2
1–3 years	113	27
4–6 years	138	33
7–10 years	87	20.8
More than 10 years	54	12.9

around 20 % of the total, and technology-driven enterprises, while smaller in number, are on the rise due to the ongoing digital transformation in the economy. Our sample's "Other" category further captures the heterogeneity inherent in the SME sector. This close alignment with established national statistics reinforces our sample's representativeness and supports our findings' generalizability to the broader SME landscape in the United Kingdom.

3.2. Measures

A 5-point Likert scale was used to record all responses with a range from 1 (Strongly Disagree) to 5 (Strongly Agree). Owens et al. (2013) 9-item scale was used to assess HL. This scale measures the leader's openness to feedback, to acknowledging others' contributions, and to learning. For example, one of the sample items is, "My leader actively seeks feedback, including when it's critical." A 5-item scale from Tierney et al. (1999), which measures the employee's ability to generate novel and useful ideas, was used to measure employee creativity. For example, a sample item is: I actively look for creative ways to enhance business processes and business results. An 8-item scale adapted from Carmeli and Spreitzer (2009), originally based on Atwater and Carmeli (2009), was used to assess vitality, including employees' energy and enthusiasm in the workplace. For instance, a sample item is, "I am energized and motivated to help our SME succeed." A 4-item scale adapted from O'Driscoll et al. (2004) was used to measure peer support. The informational and practical assistance provided by colleagues is captured by this scale. Sample item includes, 'My colleagues provide helpful information or advice that helps improve my work performance.' The 5-item scale from Lindquist and Kaufman-Scarborough (2007), assessing an individual's polychronicity, that is his or her preference for multitasking, was used. An example item is: 'I like to deal with various responsibilities (e.g., client interaction and operation) at the same time.' The measurement instruments used in this study were adapted from previous, established studies that have demonstrated strong psychometric properties (Ahmad, Ullah, et al., 2023). For instance, the Owens and Hekman (2012) scale for HL, employee creativity scale originally developed by Tierney et al. (1999), vitality scale from Atwater and Carmeli (2009), the peer support scale from O'Driscoll et al. (2004), and the scale for polychronicity from Lindquist and Kaufman-Scarborough (2007) were chosen for their validated reliability and construct validity. These scales are particularly suitable for SME contexts because they offer concise yet robust measures of key constructs such as vitality and peer support, which are critical in resource-constrained environments. The use of these scales ensures that the theoretical constructs are operationalized in a manner that is both efficient and directly relevant to the dynamics within SMEs.

Additionally, we used procedural remedies during the survey design and data collection phases to minimize common method bias. To reduce evaluation apprehension, we first ensured that no personally identifiable information was collected (which guaranteed respondent anonymity and confidentiality). Second, items for different constructs were presented in a random order to eliminate possible biases due to the response pattern. Furthermore, after data collection, we used Harman's single-factor test to ensure that no single factor could account for most of the variance in our data (Ahmad, Samad, & Han, 2023; Xu et al., 2022). In order to mitigate social desirability bias, we used indirect and neutral language in the questionnaire so that respondents do not feel that the questionnaire was prescribing any 'correct' or socially acceptable answers. Moreover, participants were assured that there were no right or wrong answers and that honest responses were critical for the research's success (Ahmad, Samad, & Mahmood, 2024). These measures ensured that the data collected accurately reflected the respondents' true perceptions and behaviors.

4. Results

The SMART-PLS analysis provided robust insights into the relationships among the study variables. Factor loadings for all items exceeded the acceptable threshold of 0.60, confirming strong construct validity. Notably, most loadings were significantly higher, surpassing 0.90 for several items, particularly within Employee Creativity (EC) and Polychronicity (POLY), demonstrating high reliability in capturing their respective constructs. The weakest loading observed for EV2 at 0.697, was still within an acceptable range, reinforcing the validity of the measurement model. Composite reliability (CR) values for all constructs surpassed the recommended threshold of 0.70, indicating high internal consistency (Ahmad, Ahmad, Lewandowska, & Han, 2024; Li et al., 2024). For instance, EC had a CR of 0.976, while EV achieved 0.967, reflecting the reliability of these constructs in measuring the intended variables. Similarly, the average variance extracted (AVE) values were well above the 0.50 threshold, with EC showing the highest AVE at 0.892, indicating strong convergent validity across the model (Ahmad, Ullah, et al., 2021; Yu et al., 2021). R-square values provided insights into the explanatory power of the constructs within the model. EC had an R-square value of 0.402, indicating that the predictors explained 40.2 % of the variance in creativity. EV showed a higher R-square value of 0.476, highlighting its critical role as an outcome variable influenced by leadership and potentially other mediating or moderating factors. Peer Support (PS) had an R-square value of 0.338, reflecting a moderate level of explained variance. These values suggest that the model captures meaningful relationships among variables while leaving room for the exploration of additional predictors or contextual factors. These results are summarized in Table 3. Fig. 1 reflects our measurement

Table 3
Factor loadings, reliability and validity.

Variable	Item	Factor Loading	Composite Reliability (CR)	Average Variance Extracted (AVE)	R-Square
EC	EC1	0.937	0.976	0.892	0.402
	EC2	0.925			
	EC3	0.957			
	EC4	0.947			
	EC5	0.954			
EV	EV1	0.913	0.967	0.786	0.476
	EV2	0.697			
	EV3	0.899			
	EV4	0.923			
	EV5	0.906			
	EV6	0.934			
	EV7	0.905			
	EV8	0.891			
HL	HL1	0.69	0.937	0.652	N/A
	HL2	0.746			
	HL3	0.799			
	HL5	0.813			
	HL6	0.859			
	HL7	0.871			
	HL8	0.85			
	HL9	0.815			
POLY	POLY1	0.928	0.965	0.846	N/A
	POLY2	0.921			
	POLY3	0.938			
	POLY4	0.92			
	POLY5	0.891			
PS	PS1	0.929	0.935	0.783	0.338
	PS2	0.936			
	PS3	0.9			
	PS4	0.762			

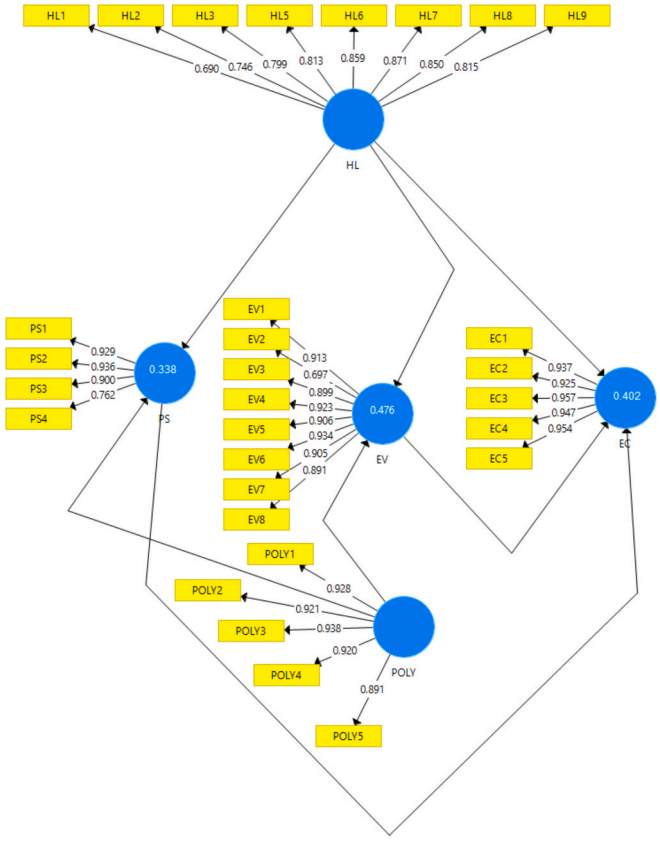

Fig. 1. The measurement model of this study.

model.

The results of the correlation matrix, Square root of Average Variance Extracted (AVE), and heterotrait-monotrait (HTMT) ratio analysis provide insights into the relationship among the study constructs and the discriminant validity of the measurement model. On the diagonal of the correlation matrix, the square root of AVEs was higher than the inter-construct correlation, implying good discriminant validity (Fornell & Larcker, 1981). The square root of AVE for EC was 0.944, larger than the correlations of EC with EV (0.414) and PS (0.467). In the same way, the square root of AVE for HL was higher than the correlations of HL with other constructs, like EC (0.398) and POLY (0.438). Discriminant validity was further supported by HTMT ratio analysis, where all HTMT ratios were found well below the conservative threshold of 0.85 (Henseler et al., 2015). For instance, the HTMT ratio between EC and EV was 0.844, and between EC and HL was 0.51. However, the HTMT ratio between PS and POLY (0.627) was the highest, which remained within acceptable limits. The results indicate that the constructs are unique and that the measurement model measures the unique variance of each variable. The results are presented in Table 4 below.

Table 4
Discriminant validity and Correlations.

Construct	EC	EV	HL	POLY	PS
EC	**0.944**	0.844 (HTMT)	0.51 (HTMT)	0.574 (HTMT)	0.587 (HTMT)
EV	0.414	**0.886**	0.527 (HTMT)	0.652 (HTMT)	0.624 (HTMT)
HL	0.398	0.484	**0.807**	0.485 (HTMT)	0.571 (HTMT)
POLY	0.353	0.323	0.438	**0.92**	0.627 (HTMT)
PS	0.467	0.387	0.444	0.299	

Notes: Diagonal values (in bold) represent the square root of AVEs. Off-diagonal values in the corresponding cells represent HTMT ratios.

The hypotheses testing results provide strong support for the proposed relationships. HL positively influenced EC, with a beta coefficient of 0.134, a t-statistic of 3.064, and a *p*-value of 0.002. The confidence interval ranged from 0.056 to 0.230, confirming the direct effect of HL on EC. Thus, H1 is accepted. HL also significantly impacted EV, with a beta coefficient of 0.278, a t-statistic of 6.226, and a *p*-value of 0.000, with a confidence interval of 0.176 to 0.356, supporting H2. EV strongly influenced EC, with a beta coefficient of 0.638, a t-statistic of 9.997, and a p-value of 0.000, within a confidence interval of 0.495 to 0.759. Thus, H3 is accepted. The mediating role of EV in the HL-EC relationship was significant, with a beta coefficient of 0.177, a t-statistic of 5.107, and a p-value of 0.000, confirming H4.

HL positively influenced PS, with a beta coefficient of 0.407, a t-statistic of 10.389, and a p-value of 0.000, within a confidence interval of 0.330 to 0.477, supporting H5. PS positively influenced EC, with a beta coefficient of 0.142, a t-statistic of 3.155, and a p-value of 0.002, supporting H6. The mediating role of PS in the HL-EC relationship was significant, with a beta coefficient of 0.058, a t-statistic of 2.856, and a p-value of 0.004, confirming H7. POLY moderated the HL → EV → EC path with a beta coefficient of 0.102, a t-statistic of 3.612, and a p-value of 0.000, supporting H8a. It also moderated the HL → PS → EC path, with a beta coefficient of 0.014, a t-statistic of 2.171, and a p-value of 0.030, confirming H8b. These findings validate the direct, mediating, and moderating effects in the model. Our results substantiate the critical mediating roles of employee vitality and peer support in translating humble leadership into enhanced employee creativity. These findings align with prior research, such as that of Carmeli and Spreitzer (2009) and Tummers et al. (2018), which emphasizes the importance of energetic and supportive work environments for fostering creative behavior. However, our study extends these insights specifically within the SME context, where resource constraints often amplify the need for internal drivers of innovation. While earlier studies in larger organizational settings reported smaller moderating effects of individual differences like polychronicity, our analysis reveals a more pronounced moderating effect. In our SME sample, higher levels of polychronicity significantly strengthen the mediating influence of employee vitality ($\beta = 0.102$) and, to a lesser extent, peer support ($\beta = 0.014$) on employee creativity. Due to their unique operational dynamics and reliance on multitasking, this divergence suggests that SMEs may benefit more substantially from the interplay between humble leadership and employees' multitasking abilities. Table 5 below includes more detail, and Fig. 2 reflects the full structural model of our study.

In Fig. 3, the simple slope analysis shows that employees who exhibit higher levels of polychronicity (green line) experience a stronger positive relationship between (HL) and EV, while employees lower in POLY (blue line) display a more modest increase in EV as HL rises. Similarly, Fig. 4 demonstrates that the positive impact of HL on PS is amplified for employees at higher levels of polychronicity. In both cases, these findings suggest that multitasking abilities significantly enhance the effects of HL on employee vitality and peer support.

5. Discussion

The findings of this study provide compelling evidence for the critical role of HL in fostering employee creativity through the mediating mechanisms of employee vitality and peer support, with polychronicity moderating these relationships. The positive relationship between HL and employee creativity aligns with existing literature that highlights the importance of leader humility in creating an environment conducive to innovation (Owens & Hekman, 2012; Zheng & Ahmed, 2024). However, our findings extend prior research by demonstrating that the influence of HL on creativity is not solely direct but is significantly mediated by employee vitality and peer support, emphasizing the multifaceted pathways through which leadership affects workplace innovation. Additionally, employee vitality was identified to be a very

Table 5
Hypotheses summary.

Path	Beta Coefficient	SD	t-Statistic	p-Value	Bias-Corrected Lower CI	Bias-Corrected Upper CI	Result
HL → EC (H1)	0.134	0.044	3.064	0.002	0.056	0.23	Supported
HL → EV (H2)	0.278	0.045	6.226	0	0.176	0.356	Supported
EV → EC (H3)	0.638	0.064	9.997	0	0.495	0.759	Supported
HL → EV → EC (H4)	0.177	0.035	5.107	0	0.105	0.243	Supported
HL → PS (H5)	0.407	0.039	10.389	0	0.33	0.477	Supported
PS → EC (H6)	0.142	0.045	3.155	0.002	0.054	0.229	Supported
HL → PS → EC (H7)	0.058	0.02	2.856	0.004	0.024	0.105	Supported
Moderating Effect 1 → EV → EC (H8a)	0.102	0.028	3.612	0	0.054	0.124	Supported
Moderating Effect 2 → PS → EC (H8b)	0.014	0.007	2.171	0.03	0.03	0.022	Supported

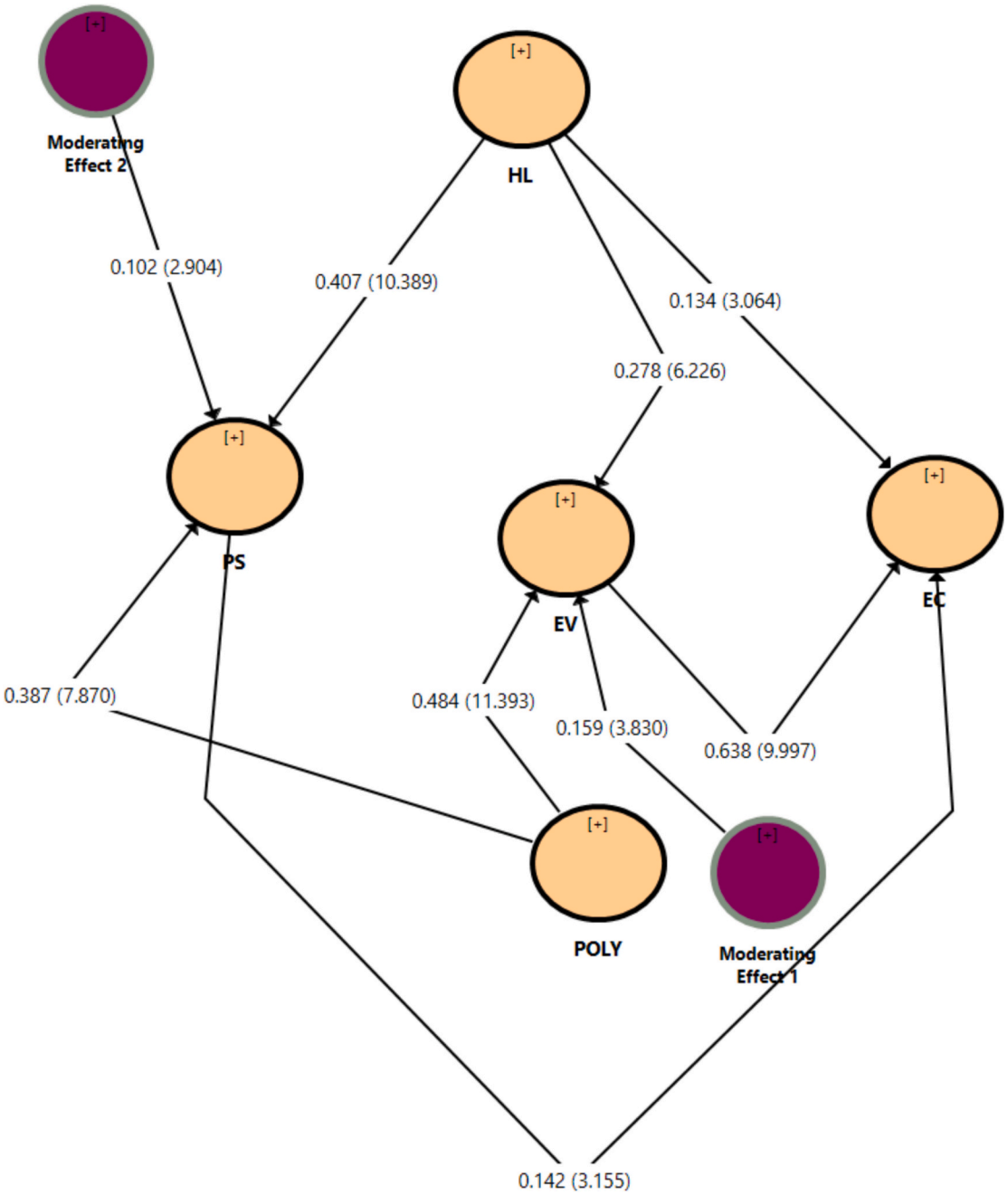

Fig. 2. The structural model of this study.

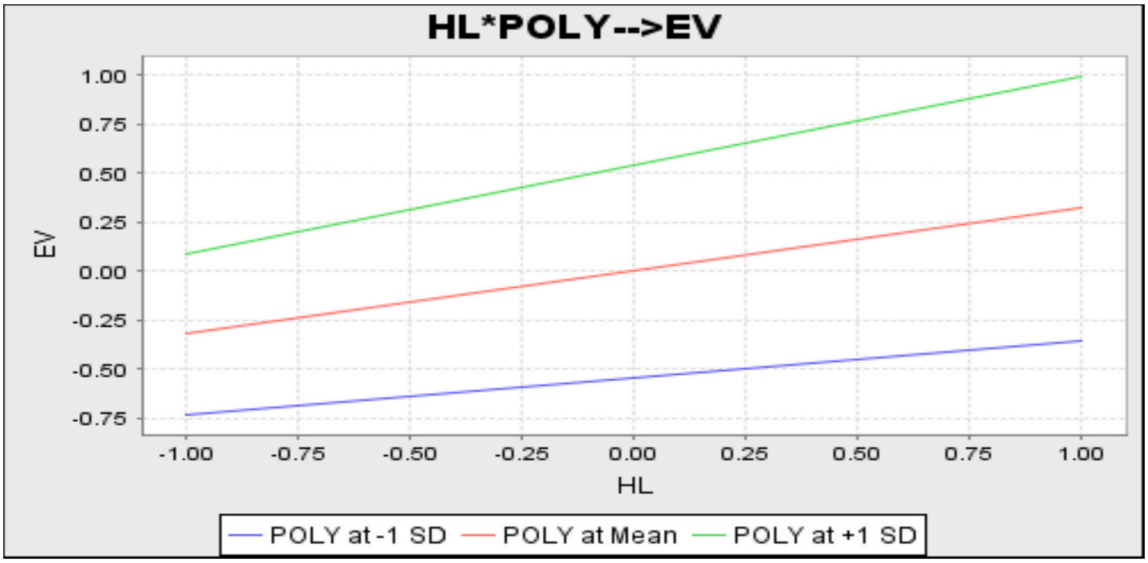

Fig. 3. Simple Slope Analysis of HL × POLY on Employee Vitality.

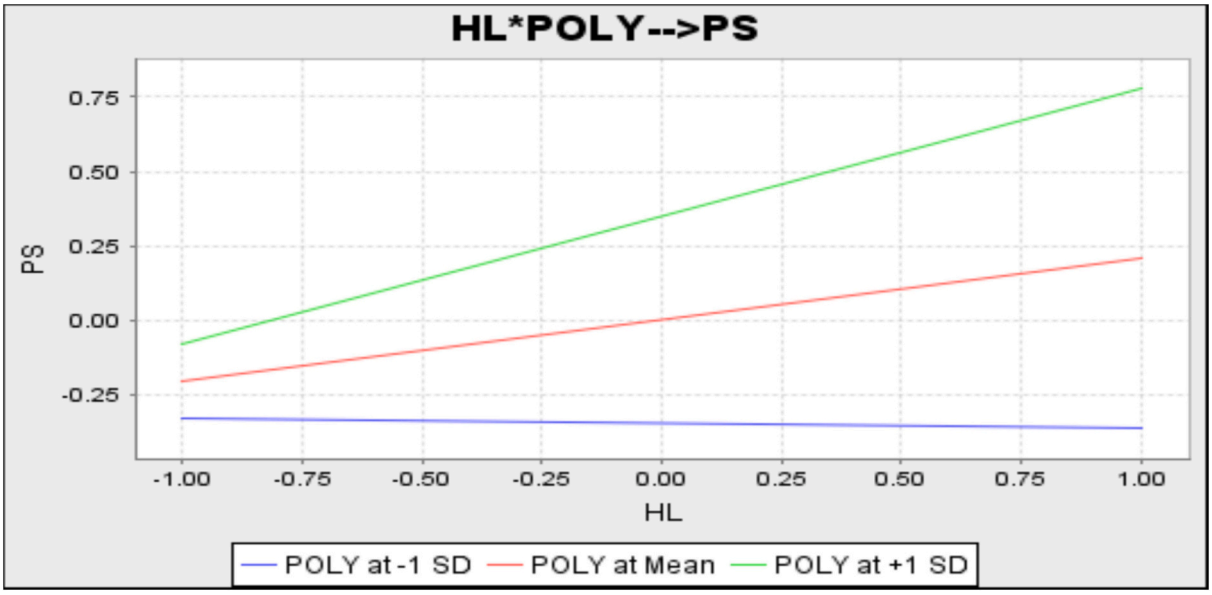

Fig. 4. Simple Slope Analysis of HL × POLY on Peer Support.

important mediator, consistent with previous studies that integrated vitality with higher levels of intrinsic motivation and creativity (Azila-Gbettor et al., 2024; Tummers et al., 2018). We find that energized and excited employees are better able to do innovative problem-solving and that HL that encourages openness and empowerment helps. This study is unique in itself firstly, by also placing employee vitality in the middle of HL and creativity in SMEs, which are often constrained in resources and thus have to rely more on internal drivers of innovation. Whereas large organizations can rely on external resources, SMEs can rely on vitality to achieve sustainable innovation, a distinction that previous research in larger organizational contexts has often overlooked.

The relationship between HL and employee creativity was also significantly mediated by peer support, consistent with prior research suggesting that collaborative networks enhance creativity (Chu et al., 2022). Employees who feel strong peer support have access to constructive feedback and knowledge sharing, which in turn enables them to develop and improve creative ideas. Our study differs from the existing literature (Zaitouni & Ouakouak, 2018) by showing how humble leaders create these peer networks specifically for SMEs. Humble leaders create a culture of inclusiveness and collaboration, including employees building trust and reciprocity among team members, which ultimately magnifies the creative potential of the entire team. Polychronicity plays the moderating role and further emphasizes the fine intricacies of leadership and creativity. Employees with high polychronicity (high ability to work on many tasks at the same time) were the ones that benefited the most from HL, specifically, vitality and peer support. The finding adds to the literature on individual differences in multitasking and creativity (Agnihotri & Bhattacharya, 2022) by showing how personal traits and leadership styles combine to influence creative output. This study is novel in including polychronicity as a moderator in understanding how leadership approaches can be optimized to leverage the creative potential of employees with varying preferences for multitasking. The findings also fill an important gap in the literature by situating the study within the SME context. Unlike large corporations, SMEs have limited resources and are under constant demand for multitasking, and leadership and employee-driven creativity is

the difference between survival and success. The results of this study offer practical implications for SME leaders; humility, vitality, peer collaboration, and task management should all be encouraged to promote creativity. In addition, these findings are contextualized within the SDGs to advance innovation and sustainable practices, such as SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation, and Infrastructure). In sum, this study validates prior findings and provides new insights into the mechanisms and boundary conditions of leadership-driven creativity in SMEs, offering a richer understanding of how HL can cultivate a dynamic and innovative workforce.

Our study is situated in the context of UK SMEs, which operate under unique cultural and economic conditions. The UK business environment is notably influenced by factors such as Brexit, evolving regulatory frameworks, and competitive market pressures. These specific dynamics may shape leadership behaviors and innovation processes in ways that differ from other contexts. We acknowledge that these cultural and economic biases may limit the generalizability of our findings beyond the UK. Future research should consider cross-cultural comparisons to further validate and extend our theoretical framework. In addition to advancing sustainable economic growth (SDG 8) and promoting innovation (SDG 9), our findings offer valuable insights for SDG 12 (Responsible Consumption and Production). The study demonstrates that humble leadership not only fosters employee creativity through enhanced vitality and robust peer support but also encourages innovative practices that optimize resource use and reduce waste. For instance, creative solutions such as IoT-enabled energy monitoring, eco-efficient product redesign, and the adoption of circular economy practices are practical examples of how UK SMEs can contribute to more responsible consumption patterns and sustainable production processes.

Moreover, our findings can be translated into actionable strategies. Consider a UK manufacturing SME that leverages humble leadership to empower its workforce to re-engineer production processes, thereby reducing energy consumption and minimizing waste. Similarly, retail SME might establish peer-driven innovation workshops to redesign packaging, leading to reduced material usage and improved recyclability. These case examples illustrate how the study's insights can be effectively implemented to overcome resource constraints and promote both economic and environmental sustainability within the SME sector.

5.1. Theoretical contribution

The findings of this study provide compelling evidence for the critical role of HL in fostering employee creativity through the mediating mechanisms of employee vitality and peer support, with polychronicity moderating these relationships. First, the positive relationship between HL and employee creativity aligns with existing literature that highlights the importance of leader humility in creating an environment conducive to innovation (Tariq et al., 2023). However, our findings extend prior research by demonstrating that the influence of HL on creativity is not solely direct but is significantly mediated by employee vitality and peer support, emphasizing the multifaceted pathways through which leadership affects workplace innovation.

Second, employee vitality, which has been previously linked to greater intrinsic motivation and creativity (Op den Kamp et al., 2023), was identified as a significant mediator. Our results showed that employees who feel energized and enthusiastic are more capable of solving innovative problems when they are led with humility that elicits openness and empowerment. The uniqueness of this study is that it positions employee vitality as a bridge between HL and creativity in the environment of the SMEs where limited resources force more reliance on internal drivers of innovation. In contrast, SMEs rely on vitality, one of their most important internal resources, to generate sustainable innovation, a detail that has been neglected in prior research in the context of larger organizations with access to many more external resources.

Furthermore, peer support significantly mediated the relationship between HL and employee creativity, consistent with earlier findings that collaborative networks increase creativity (Ghaleb & Piaralal, 2024). Strong peer support allows employees to receive constructive feedback and share knowledge, ultimately helping them to share knowledge and ultimately helping them generate and refine creative ideas. Our study is the first to show how humble leaders foster such peer networks, especially in the SME sector. Humble leaders create an inclusive and collaborative workplace culture that allows employees to develop trust and reciprocity with their teams and leverage their combined creative potential.

Finally, the moderating role of polychronicity emphasizes the nuanced dynamics of leadership and creativity. Employees with high polychronicity (i.e., the ability to multitask) gained more vitality and peer support from HL. Therefore, this finding extends the literature on individual differences in multitasking and creativity (Waheed et al., 2021) by showing how personal traits and leadership styles determine creative outcomes. This study is unique in its inclusion of polychronicity as a moderator to examine how leadership strategies can be tailored to best maximize creative potential among employees with different multitasking preferences.

This study has strong implications with the SDGs SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation and Infrastructure). This study contributes to the literature by showing how HL causes innovation in SMEs, highlighting the importance of leadership in achieving sustainable economic growth and promoting resilient, inclusive, and sustainable industrialization. Despite their importance to the global economy, SMEs are constrained by resource and failure rates. Through this study, we show how leadership, employee vitality, and peer collaboration can combine to turn these challenges into opportunities for innovation and sustainability. Aligning organizational strategies with the SDGs allows SMEs to improve their competitiveness while positively contributing to global sustainability.

This research advances the theoretical understanding of leadership and innovation by integrating the mediating roles of employee vitality and peer support and the moderating effect of polychronicity within the SME context. Our results extend the Job Demands-Resources framework by illustrating that humble leadership is particularly effective in resource-constrained environments. The study enriches existing theories by demonstrating that the interplay between leadership and creativity is sensitive to individual differences in multitasking, as reflected by polychronicity. This factor has received less attention in previous research. By focusing on UK SMEs, our research also highlights how contextual factors, such as cultural and economic conditions, can influence the dynamics of leadership and innovation. This contextualization provides a nuanced view that not only reinforces the established theoretical models but also suggests that leadership strategies must be tailored to the operational realities of SMEs. Furthermore, linking humble leadership to sustainable practices broadens the theoretical discourse by incorporating sustainability considerations, thereby aligning management practices with broader global objectives such as the SDGs.

5.2. Practical implication

The findings of our study yield several practical implications for SME leaders in the UK. Leaders are encouraged to adopt humble leadership practices by actively seeking and valuing employee feedback, recognizing contributions, and fostering a culture of openness. Such practices can be implemented through regular feedback sessions, innovation workshops, and structured team meetings that encourage idea-sharing and collaborative problem-solving. Furthermore, SME leaders should invest in targeted training programs that enhance both leadership skills and employees' multitasking abilities, as our research shows that higher polychronicity significantly strengthens the positive effects of humble leadership on creativity. Incorporating digital tools to facilitate real-time communication and collaboration can further bolster peer support networks and enhance overall responsiveness to emerging challenges. In addition, aligning these leadership strategies with

sustainability goals—such as reducing waste, optimizing resource utilization, and adopting eco-friendly practices—enables SMEs to contribute to responsible consumption and production. By translating these insights into actionable strategies, SME leaders can improve operational efficiency and employee engagement and build resilient, innovative, and sustainable business models that are well-positioned to thrive in today's competitive environment.

5.3. Limitations and future research directions

We recognize that our study's cross-sectional design and focus on UK SMEs impose certain limitations on the generalizability of our results. Future research should aim to extend these findings by exploring cross-cultural validations. Conducting studies in diverse economic and cultural settings would help determine whether the observed relationships between humble leadership, employee vitality, peer support, and creativity are consistent across different regions. Such cross-cultural investigations could reveal unique contextual factors or alternative mechanisms that influence these dynamics, thereby enriching our understanding of leadership and innovation in SMEs globally.

Additionally, longitudinal studies would provide valuable insights into the causal pathways and temporal dynamics inherent in the relationships examined in this study. By following organizations over an extended period, researchers can capture the evolution of leadership practices and their sustained impact on employee creativity and sustainability outcomes. This approach would allow for a more robust assessment of how humble leadership influences organizational change over time and under varying market conditions. Overall, addressing these avenues in future research will not only help in refining theoretical models such as the Job Demands-Resources framework in different contexts but also assist practitioners in designing leadership interventions that are sensitive to cultural nuances and temporal shifts. These efforts will ultimately contribute to a deeper and more comprehensive understanding of the role of humble leadership in driving sustainable innovation across diverse SME landscapes.

6. Conclusion

The results of this study indicate that in the context of small and medium sized enterprises, HL is essential to nurture employee creativity. This research provides a better understanding of how leadership influences workplace innovation by examining direct effects of HL on creativity and mediating roles of employee vitality and peer support. Additionally, the use of polychronicity as a moderator reveals how individual traits interact with leadership behaviors to increase creativity. The findings have significant theoretical and practical value, illustrating the multiple and evolving processes that underpin creativity in SMEs. We found that employee vitality served as a critical mediator in that energized and motivated employees were more likely than those who were tired and depleted to engage in creative problem-solving. This effect is further enhanced by peer support, which encourages employees to work collaboratively and share ideas, as well as refine innovative solutions. These results underscore the need to design workplace settings that support individual levels of energy and team levels of collaboration. The second layer of complexity is polychronicity: Polychronic employees, who are better able to multi task, benefit more from HL, vitality, and peer support in fostering creativity. This study offers actionable insights from a practical perspective for SME leaders. A HL style that embraces openness, recognition, and support can foster an innovation-friendly environment. By prioritizing employee well-being and creating team collaboration, organizations can utilize internal resources and overcome the limitations SMEs usually face. In addition, leadership practices are aligned with the SDGs, such as SDG 8 and SDG 9, so that such efforts will contribute to sustainable economic growth and resilient infrastructure.

CRediT authorship contribution statement

Fang He: Project administration, Data curation, Conceptualization. **Rana Tahir Naveed:** Validation, Supervision, Resources, Methodology, Conceptualization. **Muhammad Adnan:** Writing – review & editing, Visualization, Software, Investigation. **Volkan Çakir:** Resources, Methodology, Formal analysis, Data curation. **Warda Naseem:** Writing – original draft, Visualization, Validation, Software. **Saqib Muneer:** Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation.

Informed consent statement

Informed consent was obtained from all subjects involved in the study.

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Declaration of competing interest

The authors declare no conflict of interest.

Data availability

Data will be made available on request.

References

. (!!! INVALID CITATION !!!).

Afshar Jahanshahi, A., Brem, A., & Gholami, H. (2019). Working in a physically dangerous work environment: Employee vitality and sustainable behavior. *Sustainability, 11*(19), 5170.

Agnihotri, A., & Bhattacharya, S. (2022). CEO polychronicity and SME internationalization. *Multinational Business Review, 30*(4), 526–545.

Ahmad, N., Ahmad, A., Lewandowska, A., & Han, H. (2024). From screen to service: How corporate social responsibility messages on social media shape hotel consumer advocacy. *Journal of Hospitality Marketing & Management, 33*(3), 384–413.

Ahmad, N., Ahmad, A., & Siddique, I. (2023). Responsible tourism and hospitality: The intersection of altruistic values, human emotions, and corporate social responsibility. *Administrative Sciences, 13*(4), 105.

Ahmad, N., Han, H., & Kim, M. (2024). Elevated emotions, elevated ideas: The CSR-employee creativity nexus in hospitality. *Journal of Service Theory and Practice, 34*(6), 891–914.

Ahmad, N., Mahmood, A., Han, H., Ariza-Montes, A., Vega-Muñoz, A., Din, M.u., … Ullah, Z. (2021). Sustainability as a "new normal" for modern businesses: Are smes of Pakistan ready to adopt it? *Sustainability, 13*(4), Article 1944.

Ahmad, N., Samad, S., & Han, H. (2023). Travel and tourism marketing in the age of the conscious tourists: A study on CSR and tourist brand advocacy. *Journal of Travel & Tourism Marketing, 40*(7), 551–567.

Ahmad, N., Samad, S., & Han, H. (2024). Charting new terrains: How CSR initiatives shape employee creativity and contribute to UN-SDGs in a knowledge-driven world. *Journal of Innovation & Knowledge, 9*(4), Article 100557.

Ahmad, N., Samad, S., & Mahmood, S. (2024). Sustainable pathways: The intersection of CSR, hospitality and the United Nations' sustainable development goals. *Current Issues in Tourism*, 1–20.

Ahmad, N., Scholz, M., Arshad, M. Z., Jafri, S. K. A., Sabir, R. I., Khan, W. A., & Han, H. (2021). The inter-relation of corporate social responsibility at employee level, servant leadership, and innovative work behavior in the time of crisis from the healthcare sector of Pakistan. *International Journal of Environmental Research and Public Health, 18*(9), Article 4608.

Ahmad, N., Ullah, Z., AlDhaen, E., Han, H., & Scholz, M. (2022). A CSR perspective to foster employee creativity in the banking sector: The role of work engagement and psychological safety. *Journal of Retailing and Consumer Services, 67*, Article 102968.

Ahmad, N., Ullah, Z., AlDhaen, E., & Siddique, I. (2023). Promoting the advocacy behavior of customers through corporate social responsibility: The role of brand admiration. *Business and Society Review*.

Ahmad, N., Ullah, Z., Arshad, M. Z., waqas Kamran, H., Scholz, M., & Han, H. (2021). Relationship between corporate social responsibility at the micro-level and environmental performance: The mediating role of employee pro-environmental behavior and the moderating role of gender. *Sustainable Production and Consumption, 27*, 1138–1148.

Al Wali, J., Muthuveloo, R., & Teoh, A. P. (2022). Unravelling the nexus between creative self-efficacy, humble leadership, innovative work behaviour and job performance amongst physicians in public hospitals. *Asia-Pacific Journal of Business Administration, 14*(4), 706–726.
Amabile, T. M., & Khaire, M. (2008). Creativity and the role of the leader. *Journal of the Management Training Institute, SAIL, Ranchi, 36*(3), 48–51.
Anderson, N., Potočnik, K., & Zhou, J. (2014). Innovation and creativity in organizations: A state-of-the-science review, prospective commentary, and guiding framework. *Journal of Management, 40*(5), 1297–1333.
Atwater, L., & Carmeli, A. (2009). Leader–member exchange, feelings of energy, and involvement in creative work. *The Leadership Quarterly, 20*(3), 264–275.
Azila-Gbettor, E. M., Nutsugah, F. F., Novixoxo, J. D., Glate, S. N., & Mensah, C. (2024). Empowering employee creativity in service organizations: Unlocking the role of ownership, employee vitality and supportive leadership. *The Service Industries Journal*, 1–36.
Bakker, A. B., & de Vries, J. D. (2021). Job Demands–Resources theory and self-regulation: New explanations and remedies for job burnout. *Anxiety, Stress, and Coping, 34*(1), 1–21.
Bakker, A. B., Demerouti, E., & Sanz-Vergel, A. I. (2014). Burnout and work engagement: The JD–R approach. *Annual Review of Organizational Psychology and Organizational Behavior, 1*(1), 389–411.
Bakker, A. B., Hakanen, J. J., Demerouti, E., & Xanthopoulou, D. (2007). Job resources boost work engagement, particularly when job demands are high. *Journal of Educational Psychology, 99*(2), 274.
Carmeli, A., & Spreitzer, G. M. (2009). Trust, connectivity, and thriving: Implications for innovative behaviors at work. *The Journal of Creative Behavior, 43*(3), 169–191.
Chen, J., Ghardallou, W., Comite, U., Ahmad, N., Ryu, H. B., Ariza-Montes, A., & Han, H. (2022). Managing hospital employees' burnout through transformational leadership: The role of resilience, role clarity, and intrinsic motivation. *International Journal of Environmental Research and Public Health, 19*(17), Article 10941.
Chong, Y. K., & Zainal, S. R. M. (2024). Employee agility's moderating role on the link between employee vitality, digital literacy and transformational leadership with job performance: An empirical study. *Cogent Business & Management, 11*(1), Article 2337447.
Chu, X., Zhang, L., & Li, M. (2022). Humble leadership and work fatigue: The roles of self-efficacy and perceived team autonomy-support. *Journal of Psychology in Africa, 32*(4), 340–346.
Clark, D. (2024). Main obstacles to running a business among SMEs in the UK 2023. Retrieved November 20, 2024, from https://www.statista.com/statistics/291688/uk-obstacles-to-running-an-sme.
Costa, A., Crupi, A., De Marco, C. E., & Di Minin, A. (2023). SMEs and open innovation: Challenges and costs of engagement. *Technological Forecasting and Social Change, 194*, Article 122731.
Deng, Y., Cherian, J., Ahmad, N., Scholz, M., & Samad, S. (2022). Conceptualizing the role of target-specific environmental transformational leadership between corporate social responsibility and pro-environmental behaviors of hospital employees. *International Journal of Environmental Research and Public Health, 19*(6), 3565.
Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G* power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*(2), 175–191.
Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50.
Fu, B., Ahmad, N., Lho, L. H., & Han, H. (2023). Triple-E effect: Corporate ethical responsibility, ethical values, and employee emotions in the healthcare sector. *Social Behavior and Personality: An International Journal, 51*(12), 1–14.
Fu, Q., Cherian, J., Ahmad, N., Scholz, M., Samad, S., & Comite, U. (2022). An inclusive leadership framework to foster employee creativity in the healthcare sector: The role of psychological safety and polychronicity. *International Journal of Environmental Research and Public Health, 19*(8), 4519.
Funck, M. (2015). *Effectiveness of humble leadership for creativity and innovation in context of online-based startups: A qualitative examination*. University of Twente.
Gajdzik, B., & Wolniak, R. (2022). Smart production workers in terms of creativity and innovation: The implication for open innovation. *Journal of Open Innovation: Technology, Market, and Complexity, 8*(2), 68.
Ghaleb, M. M. S., & Piaralal, S. K. (2024). Enhancing employee creativity: Interactions between diabetic compliance, emotional support at work, and management's approach to patient autonomy. *Journal of Natural Science, Biology and Medicine, 15*(2), 390.
Guan, X., Ahmad, N., Sial, M. S., Cherian, J., & Han, H. (2023). CSR and organizational performance: The role of pro-environmental behavior and personal values. *Corporate Social Responsibility and Environmental Management, 30*(2), 677–694.
Guo, M., Ahmad, N., Adnan, M., Scholz, M., & Naveed, R. T. (2021). The relationship of CSR and employee creativity in the hotel sector: The mediating role of job autonomy. *Sustainability, 13*(18), Article 10032.
Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science, 43*, 115–135.
Hughes, D. J., Lee, A., Tian, A. W., Newman, A., & Legood, A. (2018). Leadership, creativity, and innovation: A critical review and practical recommendations. *The Leadership Quarterly, 29*(5), 549–569.
Hutton, G., & Murray, A. (2024). Business statistics. Retrieved November 20, 2024, from https://commonslibrary.parliament.uk/research-briefings/sn06152/#:~:text=There%20were%205.5%20million,business%20turnover.&text=the%20UK%20in%202023%2C,business%20turnover.&text=population.%20SMEs%20are%20businesses,business%20turnover.&text=SMEs%20accounted%20for%2061%25,business%20turnover.
Iqbal, Q., & Ahmad, N. H. (2021). Sustainable development: The colors of sustainable leadership in learning organization. *Sustainable Development, 29*(1), 108–119.
Kim, H. K., & Baik, K. B. (2015). The effects of Korean leadership style on members' creativity: Perceived supervisor support as a mediator. *Ewha Journal of Social Sciences, 31*(2).
Kirchberg, D. M., Roe, R. A., & Van Eerde, W. (2015). Polychronicity and multitasking: A diary study at work. *Human Performance, 28*(2), 112–136.
Lee, A., Legood, A., Hughes, D., Tian, A. W., Newman, A., & Knight, C. (2020). Leadership, creativity and innovation: A meta-analytic review. *European Journal of Work and Organizational Psychology, 29*(1), 1–35.
Li, Y., Ahmad, N., & Lewandowska, A. (2024). Eco-chic stays: The influence of green communication on guest booking intentions. *Journal of Vacation Marketing* (Ahead of print, 13567667241293792).
Lindquist, J. D., & Kaufman-Scarborough, C. (2007). The polychronic—Monochronic tendency model: PMTS scale development and validation. Time & Society, 16(2–3), 253–285.
Liu, C., Ahmad, N., Jiang, M., & Arshad, M. Z. (2024). Steering the path to safer food: The role of transformational leadership in food services to combat against foodborne illness. *Journal of Retailing and Consumer Services, 81*, Article 103958.
Liu, Y., Cherian, J., Ahmad, N., Han, H., de Vicente-Lama, M., & Ariza-Montes, A. (2023). Internal corporate social responsibility and employee burnout: An employee management perspective from the healthcare sector. *Psychology Research and Behavior Management*, 283–302.
Mahmood, A., Naveed, R. T., Ahmad, N., Scholz, M., Khalique, M., & Adnan, M. (2021). Unleashing the barriers to CSR implementation in the sme sector of a developing economy: A thematic analysis approach. *Sustainability, 13*(22), Article 12710.
Malik, N., Tripathi, S. N., Kar, A. K., & Gupta, S. (2021). Impact of artificial intelligence on employees working in industry 4.0 led organizations. *International Journal of Manpower, 43*(2), 334–354.
Mead, S., Hilton, D., & Curtis, L. (2001). Peer support: A theoretical perspective. *Psychiatric Rehabilitation Journal, 25*(2), 134.
Muenjohn, N., Ishikawa, J., Kongsamutr, N., Muenjohn, P., Montague, A., & Suzumura, Y. (2021). Comparing perceptions of leadership, innovation and performance in Asian SMEs. *Asia Pacific Business Review, 27*(4), 513–527.
Mumford, M. D., Scott, G. M., Gaddis, B., & Strange, J. M. (2002). Leading creative people: Orchestrating expertise and relationships. *The Leadership Quarterly, 13*(6), 705–750.
Narkhede, G., Dohale, V., & Mahajan, Y. (2024). Darker side of industry 4.0 and its impact on triple-bottom-line sustainability. *Sustainable Development, 32*(6), 5999–6016.
Narkhede, G., Mahajan, S., Narkhede, R., & Chaudhari, T. (2024). Significance of industry 4.0 technologies in major work functions of manufacturing for sustainable development of small and medium-sized enterprises. *Business Strategy & Development, 7*(1), Article e325.
O'Driscoll, M. P., Brough, P., & Kalliath, T. J. (2004). Work/family conflict, psychological well-being, satisfaction and social support: A longitudinal study in New Zealand. *Equal Opportunities International, 23*(1/2), 36–56.
Op den Kamp, E. M., Tims, M., Bakker, A. B., & Demerouti, E. (2023). Creating a creative state of mind: Promoting creativity through proactive vitality management and mindfulness. *Applied Psychology, 72*(2), 743–768.
Owens, B. P., & Hekman, D. R. (2012). Modeling how to grow: An inductive examination of humble leader behaviors, contingencies, and outcomes. *Academy of Management Journal, 55*(4), 787–818.
Owens, B. P., Johnson, M. D., & Mitchell, T. R. (2013). Expressed humility in organizations: Implications for performance, teams, and leadership. *Organization Science, 24*(5), 1517–1538.
Park, J., Chang, Y., & Kim, S. (2021). Are your vitals OK? Revitalizing vitality of nurses through relational caring for patients. Healthcare 2021, 9, 46: S note: MDPI stays neu-tral with regard to jurisdictional clai-ms in ….
Peng, J., Samad, S., Comite, U., Ahmad, N., Han, H., Ariza-Montes, A., & Vega-Muñoz, A. (2022). Environmentally specific servant leadership and employees' energy-specific pro-environmental behavior: Evidence from healthcare sector of a developing economy. *International Journal of Environmental Research and Public Health, 19*(13), 7641.
Roper, S., Belt, V., & Hart, M. (2024). Growing pains: How to help small businesses scale. Retrieved March 10, 2024, from https://www.wbs.ac.uk/news/help-small-businesses-scale/.
Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology, 25*(1), 54–67.
Ryan, R. M., & Frederick, C. (1997). On energy, personality, and health: Subjective vitality as a dynamic reflection of well-being. *Journal of Personality, 65*(3), 529–565.
Salamon, J., Blume, B. D., Orosz, G., & Nagy, T. (2022). The moderating effect of coworkers' training participation on the influence of peer support in the transfer process. *European Journal of Training and Development, 47*(10), 15–36.
Schaufeli, W. B. (2015). Engaging leadership in the job demands-resources model. *Career Development International, 20*(5), 446–463.
Shalley, C. E., & Gilson, L. L. (2004). What leaders need to know: A review of social and contextual factors that can foster or hinder creativity. *The Leadership Quarterly, 15*(1), 33–53.
Shin, Y., Kim, M., & Lee, S.-H. (2017). Reflection toward creativity: Team reflexivity as a linking mechanism between team goal orientation and team creative performance. *Journal of Business and Psychology, 32*, 655–671.
Tariq, H., Abrar, M., & Ahmad, B. (2023). Humility breeds creativity: The moderated mediation model of leader humility and subordinates' creative service performance

in hospitality. *International Journal of Contemporary Hospitality Management, 35*(12), 4117–4136.
Tierney, P., Farmer, S. M., & Graen, G. B. (1999). An examination of leadership and employee creativity: The relevance of traits and relationships. *Personnel Psychology, 52*(3), 591–620.
Tummers, L., Steijn, B., Nevicka, B., & Heerema, M. (2018). The effects of leadership and job autonomy on vitality: Survey and experimental evidence. *Review of Public Personnel Administration, 38*(3), 355–377.
Waheed, J., Jun, W., Yousaf, Z., Radulescu, M., & Hussain, H. (2021). *Towards employee creativity in the healthcare sector: Investigating the role of polychronicity, job engagement, and functional flexibility* (Paper presented at the Healthcare).
Wang, Y., & Poutziouris, P. (2010). Leadership styles, management systems and growth: Empirical evidence from UK owner-managed SMEs. *Journal of enterprising culture, 18*(03), 331–354.
Wei Tian, A., Cordery, J., & Gamble, J. (2016). Returning the favor: Positive employee responses to supervisor and peer support for training transfer. *International Journal of Training and Development, 20*(1), 1–16.
Wu, T.-J., Gao, J.-Y., Wang, L.-Y., & Yuan, K.-S. (2020). Exploring links between polychronicity and job performance from the person–environment fit perspective—The mediating role of well-being. *International Journal of Environmental Research and Public Health, 17*(10), 3711.
Xu, L., Mohammad, S. J., Nawaz, N., Samad, S., Ahmad, N., & Comite, U. (2022). The role of CSR for de-carbonization of hospitality sector through employees: A leadership perspective. *Sustainability, 14*(9), 5365.
Xue, Y., Ahmad, A., Han, H., & Lho, L. H. (2024). Healing the healers: The interplay of corporate social responsibility and leadership in the healthcare burnout epidemic. *Social Behavior and Personality: An International Journal, 52*(11), 1–14.
Yao, J., Liu, X., & He, W. (2021). The curvilinear relationship between team informational faultlines and creativity: Moderating role of team humble leadership. *Management Decision, 59*(12), 2793–2808.
Yu, H., Shabbir, M. S., Ahmad, N., Ariza-Montes, A., Vega-Muñoz, A., Han, H., … Sial, M. S. (2021). A contemporary issue of micro-foundation of CSR, employee pro-environmental behavior, and environmental performance toward energy saving, carbon emission reduction, and recycling. *International Journal of Environmental Research and Public Health, 18*(10), 5380.
Zaitouni, M., & Ouakouak, M. L. (2018). The impacts of leadership support and coworker support on employee creative behavior. *International Journal of Productivity and Performance Management, 67*(9), 1745–1763.
Zheng, Z., & Ahmed, R. I. (2024). Humble leadership and employee creative performance in China: The roles of boundary spanning behavior and traditionality. *Personnel Review, 53*(1), 193–210.
Zhou, J., & Shalley, C. E. (2011). *Deepening our understanding of creativity in the workplace: A review of different approaches to creativity research*.
Zou, Z., Liu, Y., Ahmad, N., Sial, M. S., Badulescu, A., Zia-Ud-Din, M., & Badulescu, D. (2021). What prompts small and medium enterprises to implement CSR? A qualitative insight from an emerging economy. *Sustainability, 13*(2), 952.