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HARNESSING HR DYNAMICS: KEY TO COMPETITIVE ADVANTAGE AND SUSTAINABILITY IN SMALL AND MEDIUM ENTERPRISES

Abrar Talal Rizq[1], Musrrat Parveen[2]

[1, 2] *King Abdulaziz University, Jeddah, Saudi Arabia*

e-mails: [1]arezq@kau.edu.sa, [2]mpmohammed@kau.edu.sa

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ABSTRACT

Background: Small and medium-sized enterprises (SMEs) play a critical role in driving innovation and maintaining competitive advantage in dynamic markets. ***Objective:*** The aim of this research proposes that how HR strategies directly influence dynamic capabilities, firm performance, and innovation, ultimately fostering sustainability-oriented innovation. By aligning HR practices with strategic goals, SMEs can achieve long-term competitiveness and contribute to sustainable development. ***Methods/Approach:*** Data were collected from SMEs in five regions of Saudi Arabia using convenience sampling. Online surveys were distributed to top and middle managers from January to April 2024. Of 500 questionnaires distributed, 448 responses were received, with 52 discarded due to incompleteness, missing values, or inappropriateness. We used SPSS 25 and PLS-SEM 4.0 to test the hypothesis, evaluate reliability, validity, and conduct path analysis for direct, indirect, and mediating effects using the product coefficient approach. ***Results:*** The results show that HR strategies have medium impact on dynamic capabilities (Q2 = 0.258, Q^2 effect = medium) and firm innovation (Q2 = 0.247, Q^2 effect = medium), and having larger impact on firm performance (Q2 = 0.539, Q^2 effect = Large), competitive advantage (Q2=0.350, Q^2 effect=Large) and sustainability oriented innovation (Q2=0.450, Q^2 effect=Large). Additionally, the SRMR value (0.077) and NFI value (0.904) confirmed the model's good fit. HR strategies directly enhance dynamic capabilities, firm innovation, and performance, indirectly impacting competitive advantage and sustainability-oriented innovation in SMEs. ***Conclusion:*** It highlights the importance of aligning HR practices with strategic goals to foster innovation and ensure long-term competitiveness in dynamic markets. These insights can guide top and middle managers in various SME sectors.

Keywords: HR Strategies, dynamic capabilities, firm innovation, firm performance, sustainability, competitive advantage, small and medium enterprises, quantitative methodology, PLS-SEM Software
JEL classification: M52; M53; O31; Q01; L25; L26; M13

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INTRODUCTION

Small and medium enterprises (SMEs) encounter significant hurdles in acquiring resources, especially skilled human resources and adequate funding (Ravi, 2017; Bunagan & Sison, 2018; Hasan & Almubarak, 2016; Seitzhanov et al., 2020). Moreover, SMEs often grapple with intense market competition, deficient supply chain management, technological adoption challenges, and inadequate transportation infrastructure (Islam et al., 2020; Ahmed & Chowdhury, 2009; Mussapirov et al., 2029). These difficulties compel businesses to prioritize sustainability, recognizing its criticality in maintaining operations amidst various challenges,

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conserving resources, and addressing multifaceted concerns (Belas et al., 2024; Gryshova et al., 2019). Human resources (HR) play a pivotal role in driving the sustainability agenda by illustrating how organizational sustainability goals impact business outcomes, society, and the environment. It delineates each employee's responsibility in achieving these goals, provides essential training, and equips employees with resources to implement sustainable practices effectively (Belas et al., 2024; Odinokova et al., 2018).

HR aims to enhance organizational performance by fostering a values-driven culture among employees, comprising intellectual, emotional, and social dimensions. The intellectual dimension involves educating employees to enhance their task-related knowledge and skills. The emotional aspect focuses on shaping employee attitudes and motivations through HR practices. The social dimension pertains to how individuals interact within the organization and with external stakeholders. These HR strategies have been shown to help SMEs develop dynamic capabilities, foster innovation (Al-Shammari et al., 2022), improve performance (Gede Riana et al., 2020), achieve competitive advantage (Battour et al., 2021), and promote sustainability-oriented innovation (Aslam et al., 2023).

Dynamic capabilities refer to a firm's ability to effectively utilize and transform both internal and external resources in response to rapidly changing environments (Huang & Wang, 2020). They enable organizations to identify strengths, weaknesses, opportunities, and threats, and adjust accordingly. Human resource management strategies are crucial here as they ensure that activities are aligned with the firm's strategic objectives, helping SMEs attract, motivate, and retain skilled personnel who contribute to sensing, learning, integrating, and coordinating capabilities within the organization (Ho et al., 2023). These dynamic capabilities allow SMEs to continually scan the environment for opportunities, absorb and apply new knowledge, integrate specialized knowledge across departments, and coordinate workflows among different teams.

Innovation involves utilizing knowledge to develop new or improved products or services, facilitated through inbound (acquiring external knowledge), outbound (sharing internal knowledge), or coupled (collaborative partnerships) flows (Deyassa, 2023). A firm's innovation capability depends on its capacity to exploit current capabilities and explore new opportunities, both of which are supported by dynamic capabilities (Ferreira, Cardim, et al., 2020). Therefore, SMEs that implement effective SHRM practices, possess adaptable dynamic capabilities for reconfiguring resources, and leverage these strengths are able to drive innovation, meet changing market demands, enhance organizational resilience, and maintain competitiveness in the face of technological changes, resource limitations, and evolving stakeholder expectations (Gohr et al., 2023; Ho et al., 2023; Shiferaw & Amentie Kero, 2024).

Companies can attain a competitive edge by providing enhanced value through cost efficiency, unique products, or specialization in specific market segments (Potjanajaruwit, 2018). Competitive advantage is crucial for formulating business strategies aimed at achieving sustainable growth and resilience. It encompasses all business operations and focuses on delivering superior value to customers (Potjanajaruwit, 2018). Organizations need to assess both internal and external factors, optimize resource utilization, and differentiate their offerings to establish a competitive position in the market. Central to this strategy is

sustainability, which plays a pivotal role in determining future business success and can serve as a potential source of competitive advantage. It is increasingly recognized globally for its positive impact on financial performance and the strategic opportunities it provides for companies to leverage their scale, resources, and brand positioning (Ghauri et al., 2023).

Research shows that internationalization exposes firms to stricter environmental standards, driving the adoption of sustainable innovations that enhance product innovation, internationalization capabilities, competitive advantage, and long-term global viability (Kneipp et al., 2023). Sustainable-oriented innovation (SOI) practices refer to adopting product, process, and organizational innovations with a positive environmental and social impact. Adopting SOI practices is associated with positive business performance (Kneipp et al., 2019). This association is most significant when an organization adopts innovation practices related to stakeholder engagement, emissions reduction, product-service systems, and supplier management (Kneipp et al., 2019).

As this background shows, most current research highlights how HR strategies, dynamic capabilities, innovation, competitive advantage, and sustainability-oriented innovation matter for SMEs. SMEs need a comprehensive model to help them identify ways to utilize their scarce resources better and establish a consistent, sustainable growth strategy. To address this, a model was developed using a literature review (conducted below) that proposes that HR strategies directly influence dynamic capabilities, firm performance, firm innovation, competitive advantage, and sustainability-oriented innovation in SMEs. It also hypothesizes that dynamic capabilities, firm performance, and firm innovation mediate the relationships between HR strategies and the outcomes of competitive advantage and sustainability-oriented innovation.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Direct Effects

Implementing high-performance work systems, comprising employee training, skill development, competitive compensation, career advancement opportunities, transparent communication, employee engagement, and collaborative teamwork, has been positively associated with increased knowledge sharing and innovative behavior among employees (Abbasi et al., 2020; Malik & Lenka, 2019). Similarly, strategic human resource management (SHRM) practices like flexible staffing policies, comprehensive training and development initiatives, performance management standards, rigorous selection criteria, and effective reward systems align with organizational objectives and external demands, thereby enhancing human, social, and psychological capital, and ultimately bolstering organizational resilience (Yu et al., 2022). Yu et al. (2022) also underscore the intricate relationships among SHRM, self-efficacy, and self-management in reinforcing organizational resilience within Chinese enterprises, where self-efficacy acts as a mediator between SHRM practices and organizational resilience, and self-management moderates these relationships. Thus, based on this research, HR strategies are pivotal in cultivating dynamic capabilities within SMEs.

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H1a: *HR Strategies have positive and direct significant impact on Dynamic Capabilities in SME's*

HR strategies are linked to enhanced organizational performance, including increased sales growth, competitive positioning, profit growth, and employee development (Easa & Orra, 2020; Gede Riana et al., 2020). Altındağ & Bilaloğlu Aktürk (2020) found that innovation capability positively impacts firm performance directly and through strategic human resource management (SHRM) practices like recruitment, while learning organization practices indirectly improve performance through SHRM's emphasis on learning and internal information sharing. Nafari & Rezaei (2022) demonstrated that Human Resources Strategies (HRS) significantly enhance Organizational Performance (OP), especially from non-financial perspectives, with training, development, compensation, rewards, and recruitment strategies exerting significant impacts. Bieńkowska et al. (2022) highlighted that HRM strategies improve job-related attitudes and performance, fostering a supportive work environment amid the pandemic. This supports the hypothesis that HR strategies directly influence firm performance in SMEs.

H1b: *HR Strategies have positive and direct influence on firm performance in SME's*

Systematic reviews (Easa & Orra, 2020; Lenart-Gansiniec et al., 2023) suggest that HR management practices significantly enhance organizational innovation capabilities when implemented cohesively. Specific HR practices fostering innovation include electronic/creative recruitment, innovation rewards, teamwork, specialized training, and employee participation in decision-making (Kutieshat & Farmanesh, 2022), alongside effective compensation, training, and performance assessment practices (Gede Riana et al., 2020). The impact of strategic HRM on firm innovation is mediated through employee attitudes such as self-efficacy, psychological contracts, voice behavior, and direct innovative work behavior (Li et al., 2022). HR practices can also indirectly stimulate firm innovation by nurturing psychological empowerment among employees, motivating them toward innovative behaviors that contribute to the organization's innovation capabilities (Al Daboub et al., 2024). Therefore, HR strategies are posited to directly influence firm innovation in SMEs.

H1c: *HR Strategies have positive and direct influence on firm innovation in SME's*

Quantitative studies utilizing structural equation modeling techniques have demonstrated significant positive impacts of strategic HRM practices on sustainable competitive advantage across various sectors, including manufacturing (Battour et al., 2021), banking (Pahuja et al., 2024), and higher education (Hamadamin & Atan, 2019). These effects are direct, with HR strategies explaining a considerable portion of the variance in competitive advantage, and indirect through mediating factors such as human capital development and employee commitment. A qualitative synthesis by Agustian et al. (2023) underscores that selective hiring, continuous employee training and development, motivating compensation and work environment, and adaptive HR strategies are pivotal for firms in building and sustaining competitive advantage through their HR systems. Effective HR management enables organizations to attract, cultivate, and retain a skilled, capable, and motivated workforce that drives superior performance, innovation, and agility in responding to market dynamics. Accordingly, it is hypothesized that HR strategies directly impact competitive advantage in SMEs.

H1d: *HR Strategies have positive and direct influence on competitive advantage in SME's*

Peng et al. (2024) demonstrated that strategic human resource management practices positively impact employee self-efficacy and engagement in green innovation initiatives, with self-efficacy acting as a mediator. They also found that green innovation positively enhances environmental performance, particularly when aligned with employees' values. Adomako and Nguyen (2020) indicated that HR slack—excess skilled human resources—positively influences sustainable product and process innovations, especially when supported by intangible knowledge resources like organizational know-how. However, Aslam et al. (2023) reported mixed effects of innovative HR practices on sustainability innovations, with recruitment and rewards enhancing labor productivity and eco-innovations, while redeployment practices hinder product/marketing sustainability innovations. Despite conflicting impacts from HR's innovative role, it was hypothesized that HR strategies directly impact sustainability-oriented innovation (SOI) in SMEs.

H1e: *HR Strategies have positive and direct influence on sustainability-oriented innovation in SME's*

Mutsvanga (2021) found that the seizing and reconfiguration dimensions of dynamic capabilities predict competitive advantage in SMEs. However, this relationship varies based on strategic orientation and environmental factors (Fainshmidt et al., 2019; Ferreira et al., 2020). In dynamic environments, dynamic capabilities contribute to advantage when paired with differentiation or low-cost strategies. In stable, resource-abundant contexts, they may not enhance advantage (Fainshmidt et al., 2019; Ferreira et al., 2020). Only under stable, resource-constrained conditions do dynamic capabilities synergize with a low-cost orientation for achieving competitive advantage (Fainshmidt et al., 2019; Ferreira et al., 2020). Additionally, Pundziene et al. (2021) found that dynamic capabilities indirectly enhance competitive performance by facilitating open innovation processes, including knowledge sharing within and outside the organization. Despite the complexity and contingency of these findings, it was hypothesized that dynamic capabilities directly influence competitive advantage in SMEs.

H2a: *Dynamic Capabilities have positive and direct influence on competitive advantage in SME's*

Several studies identify distinct microfoundations of dynamic capabilities relevant for SOI, including sensing opportunities through audits and monitoring (Gohr et al., 2023; Inigo & Albareda, 2019), seizing them via sustainability plans, innovation units and partnerships (Gohr et al., 2023; Inigo & Albareda, 2019), and reconfiguring resources through process improvements, technology deployment and institution-wide implementation (Gohr et al., 2023; Inigo & Albareda, 2019). Eikelenboom & de Jong (2019) found that while external integrative capabilities enhancing stakeholder collaboration boosted sustainability performance in SMEs, excessive internal integration could constrain SOI. Ortiz-Avram et al. (2023) propose an evolutionary typology where firms progress from internal eco-efficiencies to systemic sustainability transformations by increasing SOI novelty and stakeholder integration levels. Additionally, Yi & Demirel (2023) reveal contrasting effects of different sustainability-oriented dynamic capabilities on firm growth, with internal green process/product capabilities paying off long-term, but external supply chain integration initially hindering

growth. Considering this evidence, it was hypothesized that dynamic capabilities directly influence sustainability-oriented innovation (SOI) in SMEs.

H2b: *Dynamic Capabilities have positive and direct influence on sustainability-oriented innovation in SME's*

Wanjiru et al. (2019) discovered that competitive advantage, involving innovation, value chain integration, and market leadership, partially mediated the effects of corporate strategies on firm performance, emphasizing its crucial role in translating strategies into superior performance. Other studies indicate that competitive advantage, measured through differentiation and cost leadership, significantly enhances firm performance (Ong et al., 2018; Karaev, 2023). Interestingly, strong buyer and supplier bargaining power amplify rather than diminish the performance benefits SMEs derive from their differentiation and cost advantages (Ong et al., 2018; Karaev, 2023). Potjanajaruwit (2018) highlighted technological capability and inter-organizational collaboration as pivotal drivers of competitive advantage for startups, directly and indirectly enhancing their performance by improving competitive positioning. This supports the proposal that firm performance directly influences competitive advantage in SMEs.

H3a: *Firm Performance have positive and direct influence on competitive advantage in SME's*

Xue et al. (2019) and Bernal-Torres et al. (2023) indicated that managerial environmental concern strengthened the positive impact of green innovation on financial performance. Firms with strong managerial commitment to environmental priorities effectively translated green innovations into improved profitability compared to those with lower environmental concern. Liu (2023) demonstrated that increased green innovation reduced firm risk (volatility, credit risk), raised valuations, particularly in environmentally sensitive industries, and enhanced environmental emissions performance. Additionally, Khanchel et al. (2023) showed that the interaction between green innovation and social disclosure positively influenced financial performance, with this effect being more pronounced in high-performing firms. Based on these findings, it was hypothesized that performance directly correlates with sustainability-oriented innovation (SOI) in SMEs.

H3b: *Firm Performance have positive and direct influence on sustainability-oriented innovation in SME's*

Siriram et al. (2023) suggest that firms must cultivate an "innovation portfolio" encompassing various types such as product, process, marketing, and organizational innovations to establish and maintain competitive advantages over time. Product innovations typically dominate early lifecycle stages, with process, service, and organizational innovations gaining significance in later stages. Lee & Yoo (2019) found that dynamic capabilities—such as sensing opportunities, seizing them through R&D and collaborations, and reconfiguring resources—not only directly influence competitive advantage (through seizing capability) but also indirectly enhance product innovation performance. Baláž et al. (2023) highlighted the immediate revenue and profit gains from process and organizational innovations, while emphasizing the long-term importance of R&D and innovation capabilities for sustained sales growth and asset accumulation across years. Therefore, it is plausible that firm innovation directly impacts competitive advantage in SMEs.

H4a: *Firm Innovation have positive and direct influence on competitive advantage in SME's*

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Studies consistently demonstrate a positive correlation between a company's innovation culture, capabilities, and ability to pursue sustainability-oriented innovation (SOI) strategies (Rubio-Andrés & Abril, 2023; Jin et al., 2018). Companies that cultivate a balanced, open organizational culture integrating environmental and social principles into their core business approach tend to excel in SOI. An embedded innovation culture characterized by openness to change, risk-taking, and future market orientation better equips firms to develop sustainability-focused innovations irrespective of size. In the context of social enterprises specifically, research reveals SOI manifests through product innovations like affordable, eco-friendly designs as well as process/organizational innovations, including stakeholder engagement, sustainable business models, ICT, and employee well-being initiatives (Harsanto et al., 2022). Interestingly, process/organizational SOI seems more widely adopted than product SOI among social enterprises. In line with this, it was hypothesized that firm innovation directly influences sustainability-oriented innovation (SOI) in SMEs.

H4b: *Firm Innovation have positive and direct influence on sustainability-oriented innovation in SME's*

Specific Indirect Effects

Strategic human resource management (SHRM) practices aligned with organizational goals play a crucial role in developing dynamic capabilities, encompassing the firm's ability to sense, learn, integrate, and coordinate resources (Ho et al., 2023). These dynamic capabilities are essential for SMEs to innovate, adapt to changing environments, and gain a competitive edge by responding quickly to market demands and innovating products or services. Additionally, entrepreneurial orientation moderates the relationship between SHRM, dynamic capabilities, and innovation, suggesting that SMEs with a strong entrepreneurial mindset can leverage greater value from their dynamic capabilities, ultimately enhancing their innovative performance and competitive advantage (Ho et al., 2023). Furthermore, the Resource-Based View (RBV) and dynamic capabilities theory emphasize the importance of intangible resources, such as digital capabilities and organizational learning, in contributing to long-lasting competitive advantages (Wang et al., 2024). Employee dynamic capabilities, driven by organizational learning and digital capabilities play a critical role in influencing employee digital performance and, consequently, the organization's competitive advantage, particularly in a competitive climate (Wang et al., 2024). It was thus hypothesized that HR strategies indirectly influence competitive advantage in SMEs through the mediating role of dynamic capabilities.

H5: *HR Strategies indirectly influence competitive advantage in SME's through mediating role of dynamic capabilities*

Empirical research has demonstrated significant relationships among strategic human resource management practices (SHRMP), intangible and tangible firm performance, and competitive advantage (Mohammed et al., 2021). Additionally, high-performance HRM systems, aimed at improving employee skills, participation, job analysis, performance evaluation, development, and job security, positively impact innovation and firm performance (Nguyen & Dao, 2023). While high-performance HR practices directly influence innovation, their effect on firm performance is mediated by innovation. Talent management practices, as an integral part of HRM, have also been found to increase firm performance and contribute to sustainable

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competitive advantage (Altındağ & Bilaloğlu Aktürk, 2020). Furthermore, effective recruitment and selection practices, by attracting and selecting skilled employees, can improve organizational and financial performance, indirectly leading to competitive advantages (Altındağ & Bilaloğlu Aktürk, 2020). In this regard, it was hypothesized that HR strategies indirectly influence competitive advantage in SMEs through the mediating role of firm performance.

H6: *HR Strategies indirectly influence competitive advantage in SMEs through the mediating role of firm performance*

Wongsansukcharoen & Thaweepaiboonwong (2023) and Nguyen & Dao (2023) found that innovative HR practices like strategic recruitment, training, compensation, and employee development positively impact a firm's innovation capabilities, which in turn drive competitive advantage. However, the HR practices did not directly affect competitive advantage themselves - innovation capabilities fully mediated this relationship. Similarly, Ploypailin Kijkasiwat et al. (2024) demonstrated that corporate innovation also fully mediates the link between corporate governance factors and firm performance. Collectively, this research suggests HR strategies aimed at fostering innovation, whether through HR practice innovations or facilitating improved innovation capabilities more broadly, can indirectly enhance competitive positioning for firms by building their innovation strengths. In line with these results, it was proposed that HR strategies indirectly influence competitive advantage in SMEs through the mediating role of firm innovation.

H7: *HR Strategies indirectly influence competitive advantage in SMEs through the mediating role of firm innovation*

Alenazi & Alanazi (2023) found that social customer relationship management (s-CRM), a form of social capital and relational resource, enhances a firm's sustainable dynamic capabilities, which are crucial for sensing, seizing, and reconfiguring resources to adapt to changing customer needs and market conditions. These sustainable dynamic capabilities then enable the firm to develop and maintain a sustainable competitive advantage. Similarly, Subramaniam et al. (2023) revealed that e-leadership qualities, encompassing agile leadership, hybrid skill development, and digital entrepreneurship, positively impact dynamic capabilities. These dynamic capabilities, in turn, positively influence innovation management, mediating the relationship between e-leadership qualities and innovation management. Thus, it was hypothesized that HR strategies indirectly influence sustainability-oriented innovation (SOI) in SMEs through the mediating role of dynamic capabilities.

H8: *HR Strategies indirectly influence sustainability-oriented innovation (SOI) in SMEs through the mediating role of dynamic capabilities*

Effective HRM practices like recruitment, training, performance assessment, employee participation, and compensation systems enhance a firm's innovation capabilities and culture (Gede Riana et al., 2020; Rubio-

Andrés & Abril, 2023), which in turn facilitates its sustainability orientation and ability to generate innovative sustainability-focused outcomes (Jin, Navare & Lynch, 2018). Additionally, HR strategies focused on high-performance work practices and developing dynamic capabilities through agile leadership and digital entrepreneurship enable firms to better sense, seize, and reconfigure resources to address sustainability challenges (Alenazi & Alanazi, 2023; Subramaniam et al., 2023). These dynamic capabilities mediate the impact of HR strategies on sustainability innovation management. Furthermore, strategic HRM practices foster knowledge management, innovation performance, and firm performance sequentially (Chawla et al., 2022), while high-performance HRM enhances innovation capabilities that drive firm performance (Nguyen & Dao, 2023) - this improved firm performance then unlocks greater capacity for sustainability-focused innovation. Thus, it was proposed that HR strategies indirectly influence sustainability-oriented innovation (SOI) in SMEs through the mediating role of firm innovation.

H9: *HR Strategies indirectly influence sustainability-oriented innovation (SOI) in SMEs through the mediating role of firm innovation*

Nguyen & Dao (2023) found that high-performance human resource management (HPHRM) practices positively impact a firm's innovation capabilities, which in turn positively influence firm performance. However, HPHRM practices do not directly affect firm performance; their influence is fully mediated through the firm's innovation capabilities. These findings suggest that HR strategies focused on developing high-performance work practices can enhance a firm's overall innovation capacity, enabling better sustainability-oriented innovation and performance outcomes. Similarly, Chawla et al. (2022) revealed that strategic HRM practices, including selection, training, appraisal, rewards, and empowerment; enhance knowledge management capability and innovation performance, sequentially mediating the relationship between HRM and firm performance. In this regard, it was hypothesized that HR strategies indirectly influence sustainability-oriented innovation (SOI) in SMEs through the mediating roles of firm performance and innovation capabilities.

H10: *HR Strategies indirectly influence sustainability-oriented innovation (SOI) in SMEs through the mediating roles of firm performance and innovation capabilities.*

Based on the explanation of the hypothesis discussed, the following is a framework for the research model used, as show in figure 1.

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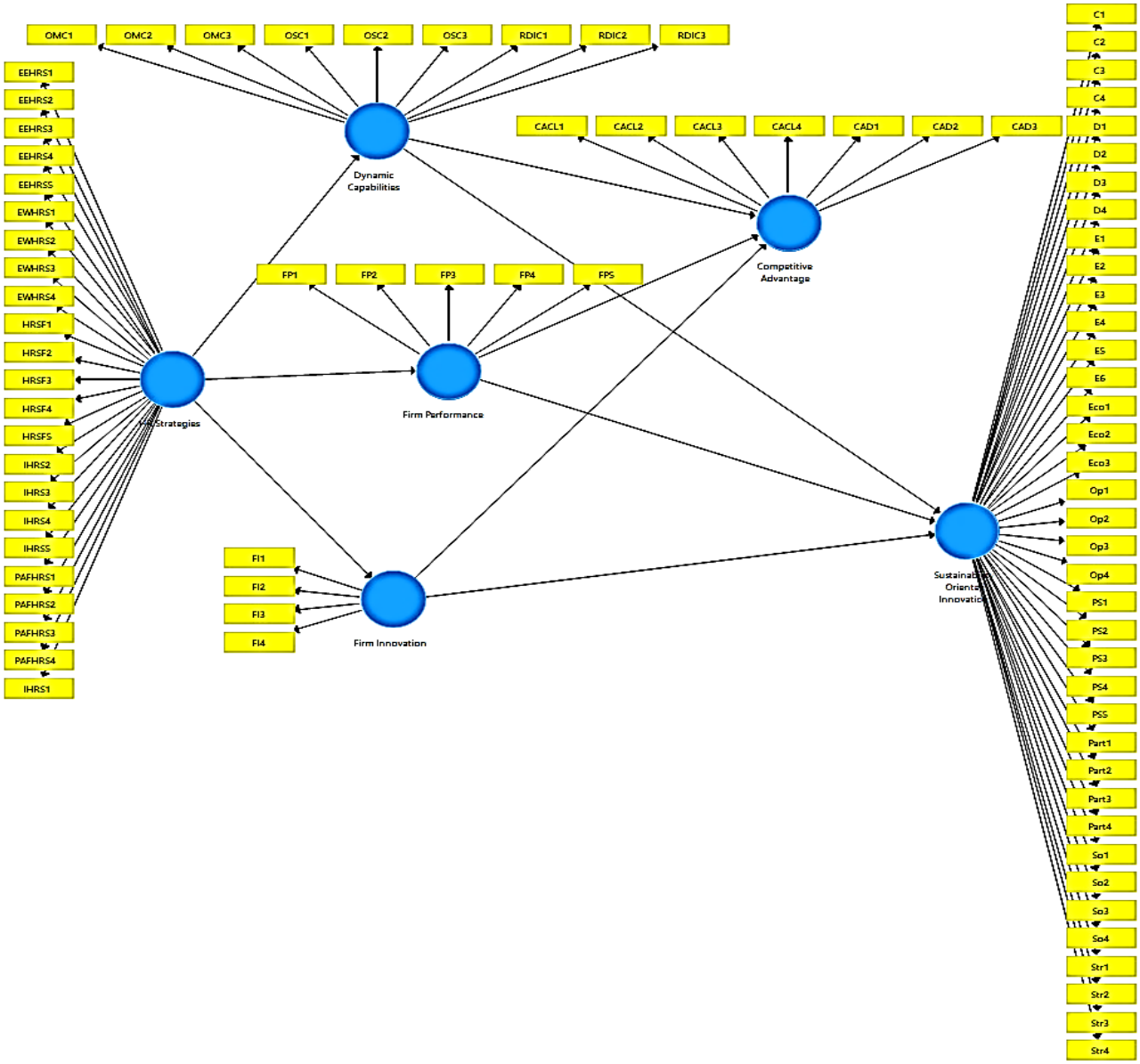

Figure 1. Conceptual Model
Source: Author's elaboration

RESEARCH METHODOLOGY

Data were collected from small and medium enterprises located in five different regions (Riyadh, Makkah, Jeddah, Eastern province and other region). Firstly, SME's are regarded as the backbone of the whole gulf region, as they account for nearly 70% of the gross domestic product and 80% of the workforce. The context of SMEs is important given the ambitious 2030 vision of the Kingdom, which aims to raise the contribution of SMEs towards GDP to 35% (from 20%). The vision further aims to focus on sustainable solutions for SMEs across the Kingdom of Saudi Arabia (Saudi Vision, 2030, 2016). Therefore, these two factors signify an appropriate research context.

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Next, SMEs from each stratum were selected based on convenience sampling. We contacted the SME owners and managers by telephone from January until April, 2024 and distributed the survey online to seek cooperation for participation in the study. The respondents were assured of anonymity of identity and confidentiality of their responses. 500 questionnaires were distributed to SMEs across different industries. After a few reminders, 448 responses were received by the authors, 52 responses were discarded due to incompleteness, which resulted in a response rate of 90%. Table 1 highlights the demographics of the sample collected.

Table 1. Demographic Variables

Variables	N	Variables	N
Gender		**No. of Employees**	
Male	247	5-50 employees	172
Female	201	51-100 Employees	153
Nationality		101-150 Employees	53
Saudi	396	151-200 Employees	49
Non-Saudi	52	200-249 Employees	21
Ownership Structure		**Experience**	
Private	352	Less than one year	123
Government	74	1 – 5 Years	211
Mixed Ownership	22	6 – 10 Years	87
Position		11 – 15 Years	20
Top Manager	65	Above 15 Years	7
Medium Manager	383	**Qualification**	
Small and Medium Enterprises		Masters	76
Retail	117	Bachelors	257
E-commerce	92	Diploma	115
Hospitality/Tourism	77	**Region**	
Food services	50	Riyadh	174
Service based	63	Makkah	104
manufacturing	24	Eastern Province	52
Oil related services	25	Jeddah	89
Market Orientation		Other Region	29
Local	411		
Regional	30		
Global	7		

Survey N=448

In Saudi Arabia, small and medium enterprises (SMEs) are primarily found in retail (117), e-commerce (92), and hospitality/tourism (77). The food services sector includes 50 SMEs, while service-based enterprises total 63. Manufacturing and oil-related services have fewer SMEs, with 24 and 25, respectively. Most SMEs are privately owned (352), with government ownership at 74 and mixed ownership at 22. Regionally, Riyadh leads with 174 SMEs, followed by Makkah (104), Jeddah (89), Eastern Province (52), and other regions (29). This distribution emphasizes Riyadh's central role and the significance of retail and e-commerce sectors, reflecting the entrepreneurial drive of Vision 2030. Six types of scales were employed to measure independent

and dependent variables: HR strategies, dynamic capabilities, firm performance, firm innovation, competitive advantage, and sustainability-oriented innovation. SPSS 24 and PLS-SEM 4.0 were used for testing.

RESULTS AND INTERPRETATION

Exploratory factor analysis

Next, exploratory factor analysis (EFA) was conducted using principal component analysis and varimax rotation in SPSS 24. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, which was 0.85, indicated suitability for factor analysis. Bartlett's test of sphericity confirmed the appropriateness of the data for factor analysis based on the X2 value. The analysis identified a 3-factor solution that explained 65% of the variance. Following guidelines from Field (2005) and Hair et al. (1998), items with factor loadings exceeding 0.50 on other factors and communalities below 0.40 were eliminated. Consequently, items IHRS1, IHRS 5, PAFHRS1, EEHRS5, EWHRS5, EWHRS1, HRSF1, RDIC1, FP1, CACL3, CACL4, D1, and D2 were removed from the analysis.

Confirmatory Factor analysis

The PLS-SEM method evaluates measurement models using reliability, convergent validity, and divergent validity. Researchers followed Dijkstra and Henseler's (2015) approach to assess the reliability and validity of reflective constructs, preferring composite reliability (CR) over Cronbach's alpha for its accuracy with higher factor loads. Convergent validity was tested through average variance extracted (AVE) and CR values. With the removal of items all factor loadings exceeded 0.50, and AVEs were above 0.5, fulfilling the criteria for convergent validity (Fornell and Larcker, 1981; Peng and Lai, 2012). The reliability and validity assessments for HR Strategies, Dynamic Capabilities, Firm Performance, Firm Innovation, Competitive Advantage, and Sustainability Oriented Innovation are conducted. For HR Strategies with a Cronbach's alpha of 0.872, composite reliability (CR) of 0.888, and average variance extracted (AVE) of 0.568. Dynamic Capabilities with a Cronbach's alpha of 0.725, composite reliability (CR) of 0.804, and average variance extracted (AVE) of 0.658. Firm Performance with a Cronbach's alpha of 0.867, composite reliability (CR) of 0.910, and average variance extracted (AVE) of 0.71.

Table 2. Heterotrait - Monotrait Ratio (HTMT)

Variables	Competitive Advantage	Dynamic Capabilities	Firm Innovation	Firm Performance	HR Strategies	Sustainablity Oriented Innovation
Competitive Advantage						
Dynamic Capabilities	0.627					
Firm Innovation	0.594	0.477				
Firm Performance	0.651	0.463	0.723			
HR Strategies	0.303	0.403	0.449	0.268		
Sustainablity Oriented Innovation	0.41	0.375	0.411	0.487	0.527	

Source: Developed by authors

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Firm Innovation with a Cronbach's alpha of 0.712, CR of 0.832, and AVE of 0.699. Competitive Advantage with a Cronbach's alpha of 0.708, CR of 0.909, and AVE of 0.788 and Sustainability Oriented Innovation with a Cronbach's alpha of 0.956, Composite Reliability of 0.926, and AVE of 0.898. Overall, the constructs show robust psychometric properties having good reliability and validity. Table 2 shows the discriminant validity using Heterotrait-Monotrait Ratio (HTMT) Criterion.

Assessment of Model Evaluation

After satisfying the results of the measurement model, the next stage is to run the model to determine the regression part of the model. The authors adhered to the recommendations of Hair et al. (2019) and used various criteria to evaluate and predict the impact of exogenous factors on endogenous variables. These criteria included Q2 (greater than 0.00), NFI (greater than 0.90), and the SRMR score (less than 0.08) as shown in Table 3 below.

Table 3. Assessment of Model Evaluation

Variables	SRMR	NFI	Q^2	Q2 Effect
HR Strategies	0.077	0.904		
Dynamic Capabilities			0.258	Medium
Firm Innovation			0.247	Medium
Firm Performance			0.539	Large
Competitive Advantage			0.350	Large
Sustainability Oriented innovation			0.450	Large

Note:
SRMR (Standardized Root Mean Square Residual); NFI (Normed Fit Index); Q^2 predict for Predictive Relevance; Q2 Effect Size

The endogenous variables in Table 3, namely dynamic capabilities (Q2 = 0.258, Q2 effect = medium), firm innovation (Q2 = 0.247, Q2 effect = medium), firm performance (Q2 = 0.539, Q2 effect = Large), competitive advantage (Q2=0.350, Q2 effect=Large) and Sustainability oriented innovation (Q2=0.450, Q2 effect=Large) all had good Q2 values and size indicating that the model accurately captured the empirical data and had good predictive capacity (Henseler et al. 2014). Additionally, the SRMR value (0.077) and NFI value (0.904) confirmed the model's good fit. HR strategies significantly influence various organizational dimensions, though their impact may vary in magnitude. *Medium Impact on Dynamic Capabilities and Firm Innovation*: HR strategies foster dynamic capabilities and innovation by attracting, developing, and retaining talent with the necessary skills and competencies. Effective HR practices, such as training, development, and knowledge-sharing, enhance employees' ability to adapt to changes and drive innovation. However, the medium impact (0.258 and 0.247) indicates that while HR strategies are critical, they are part of a broader set of factors influencing these areas, including technology, market conditions, and organizational culture. *Large Impact on Firm Performance, Competitive Advantage, and Sustainability-Oriented Innovation*: HR strategies have a pronounced effect on firm performance (0.539), competitive advantage (0.350), and sustainability-oriented innovation (0.450). By implementing robust HR practices, firms can improve employee productivity, morale, and retention, leading to enhanced performance. Strategic HR management also cultivates a workforce that is

more skilled and motivated, giving the firm a competitive edge. Additionally, HR strategies that promote sustainable practices and innovation align employees' efforts with long-term environmental and social goals, fostering a culture of sustainability.

Hypothesis Testing

To test the proposed hypothesis, both the PLS algorithm and bootstrapping technique were employed in SmartPLS 4.0. Table 4 displays the beta values that indicate the strength and significance of the positive relationship between the independent and dependent variables, where dynamic capabilities, firm innovation and firm performance acting as mediating variables.

Direct Hypothesis Testing

The study confirms that HR strategies significantly impact dynamic capabilities (β = 0.329, t = 7.289, p = 0.000), supporting H1a. Similarly, HR strategies positively influence firm performance (β = 0.231, t = 4.404, p = 0.000), thereby supporting H1b. Additionally, HR strategies demonstrate a positive influence on firm innovation (β = 0.265, t = 5.380, p = 0.000), supporting H1c, and on competitive advantage (β = 0.265, t = 6.727, p = 0.000), supporting H1d. Moreover, HR strategies contribute positively to sustainability-oriented innovation (β = 0.175, t = 5.390, p = 0.000), supporting H1e. Furthermore, dynamic capabilities positively influence competitive advantage (β = 0.179, t = 5.759, p = 0.000) and sustainability-oriented innovation (β = 0.129, t = 2.371, p = 0.003), supporting H2a and H2b, respectively. Firm performance also positively impacts competitive advantage (β = 0.627, t = 14.597, p = 0.000) and sustainability-oriented innovation (β = 0.435, t = 8.788, p = 0.000), supporting H3a and H3b, respectively. Lastly, firm innovation positively influences competitive advantage (β = 0.189, t = 4.992, p = 0.000), supporting H4a, and sustainability-oriented innovation (β = 0.074, t = 1.408, p = 0.005), supporting H4b. These findings emphasize the pivotal role of HR strategies and organizational capabilities in enhancing various facets of SME performance and sustainability.

Specific Indirect Hypothesis Testing

HR strategies indirectly impact competitive advantage in SMEs through dynamic capabilities (β = 0.61, t = 4.487, p = 0.000), affirming H5. Similarly, HR strategies affect competitive advantage via firm performance (β = 0.152, t = 4.524, p = 0.000), supporting H6, and through firm innovation (β = 0.051, t = 3.723, p = 0.000), supporting H7. Additionally, HR strategies influence sustainability-oriented innovation (SOI) through dynamic capabilities (β = 0.046, t = 2.046, p = 0.000), supporting H8, and via firm innovation (β = 0.023, t = 1.287, p = 0.004), supporting H9. Moreover, HR strategies impact SOI through the combined mediating roles of firm performance and innovation capabilities (β = 0.106, t = 3.976, p = 0.000), affirming H10. These findings underscore the indirect pathways through which HR strategies enhance competitive advantage and sustainability-oriented innovation in SMEs. Figure 2 and table 4 displays the direct and specific indirect effects of the variables as shown below:

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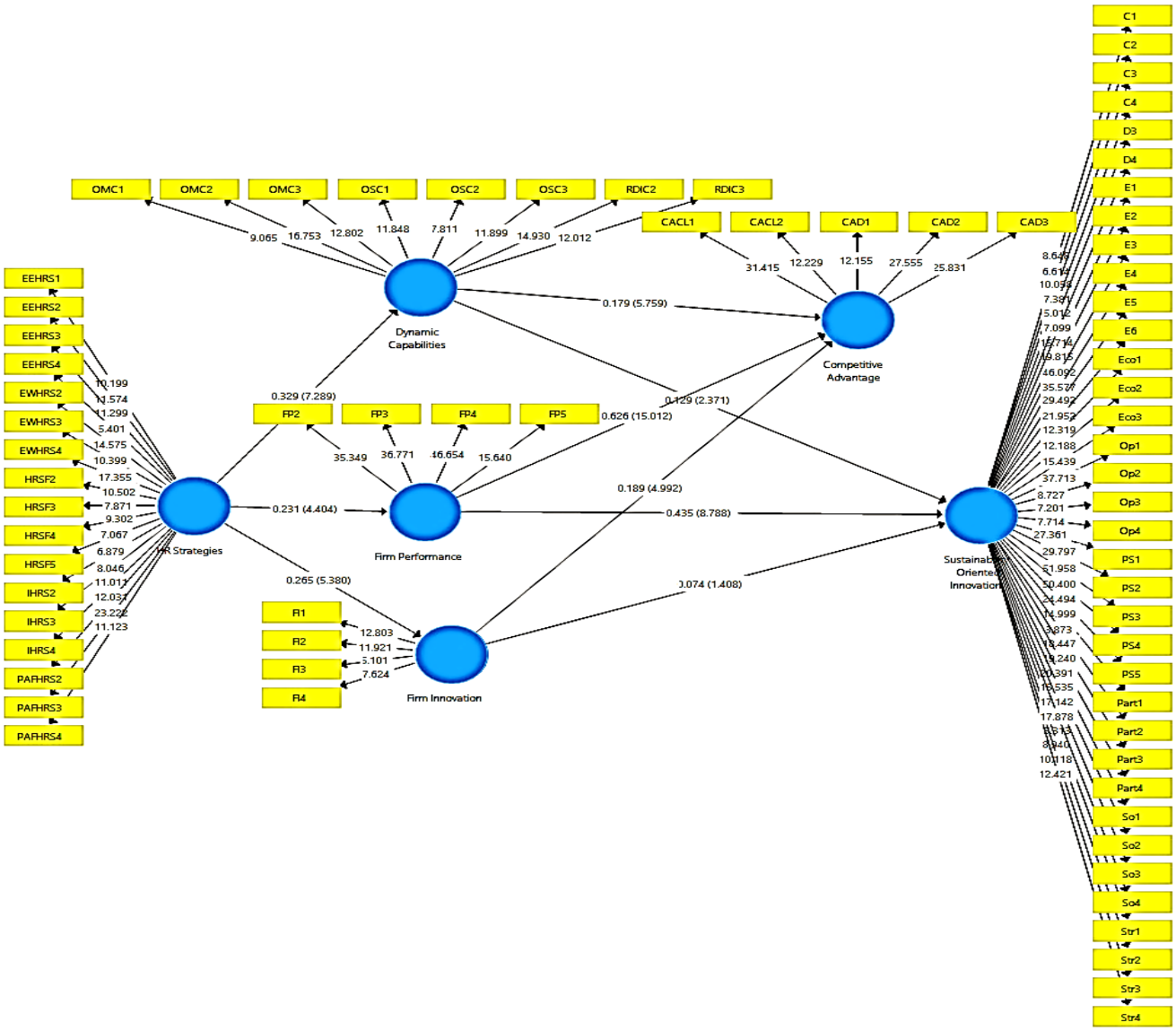

Figure 2. Results of Direct and Indirect Effects
Source: Author's elaboration

Table 4. Direct and Specific Indirect Effects

Hypothesis	Direct	β	T -Value	P Values
H1a	HR Strategies -> Dynamic Capabilities	0.329	7.289	0.000
H1b	HR Strategies -> Firm Performance	0.231	4.404	0.000
H1c	HR Strategies -> Firm Innovation	0.265	5.380	0.000
H1d	HR Strategies -> Competitive Advantage	0.265	6.727	0.000
H1e	HR Strategies -> Sustainability Oriented Innovation	0.175	5.390	0.000
H2a	Dynamic Capabilities -> Competitive Advantage	0.179	5.759	0.000
H2b	Dynamic Capabilities -> Sustainability Oriented Innovation	0.129	2.371	0.003
H3a	Firm Performance -> Competitive Advantage	0.627	14.597	0.000
H3b	Firm Performance -> Sustainability Oriented Innovation	0.435	8.788	0.000
H4a	Firm Innovation -> Competitive Advantage	0.189	4.992	0.000

H4b	Firm Innovation -> Sustainability Oriented Innovation	0.074	1.408	0.005
Hypothesis	**Specific Indirect Effects**	**β**	**T -Value**	**P Values**
H5	HR Strategies -> Dynamic Capabilities -> Competitive Advantage	0.061	4.487	0.000
H6	HR Strategies -> Firm Performance -> Competitive Advantage	0.152	4.524	0.000
H7	HR Strategies -> Firm Innovation -> Competitive Advantage	0.051	3.723	0.000
H8	HR Strategies -> Dynamic Capabilities -> Sustainability Oriented Innovation	0.046	2.046	0.000
H9	HR Strategies -> Firm Innovation -> Sustainability Oriented Innovation	0.023	1.287	0.004
H10	HR Strategies -> Firm Performance -> Sustainability Oriented Innovation	0.106	3.976	0.000

Note: Significance at the 0.05 level; Hypothesis testing (SMART PLS 4.0)

DISCUSSION

The findings of this study shed light on the strength and significance of the positive relationship between the independent and dependent variables, where dynamic capabilities, firm innovation and firm performance acting as mediating variables. The study employed a path analysis approach to examine the direct and indirect effects of these variables and utilized the product coefficient approach to assess potential mediating effects.

Firstly, through direct hypothesis testing, it is evident that HR strategies significantly bolster dynamic capabilities in SMEs, supported by robust statistical evidence (β = 0.329, t = 7.289, p = 0.000), thus validating H1a. This underscores the pivotal role of strategic HR initiatives in cultivating adaptability and responsiveness within small and medium-sized enterprises. Such practices enable SMEs to innovate, adapt to market shifts, and sustain a competitive advantage. This aligns with previous studies (Abbasi et al., 2020; Malik & Lenka, 2019; Yu et al., 2022) emphasizing the impact of HR practices like training, skill development, career advancement, flexible staffing, and performance standards on enhancing human, social, and psychological capital. These frameworks foster knowledge sharing and constructive employee behavior, further reinforcing dynamic capabilities.

Secondly, HR strategies exhibit a significant positive impact on firm performance in SMEs, backed by strong statistical support (β = 0.231, t = 4.404, p = 0.000), confirming H1b. This finding underscores how effective HR practices contribute to operational efficiency, productivity gains, and overall business success in small and medium-sized enterprises.

Investing in strategic HR initiatives such as employee training, development, and performance management can enhance SMEs' performance and competitiveness, underscoring HR management's crucial role in driving organizational success. This is consistent with previous research (Easa & Orra, 2020; Gede Riana et al., 2020; Nafari & Rezaei, 2022). Recent studies (Lenart-Gansiniec et al., 2023; Kutieshat & Farmanesh, 2022; Li et al., 2022) further affirm that HR strategies positively influence firm innovation in SMEs (β = 0.265, t = 5.380, p = 0.000), supporting H1c. These findings highlight HR's pivotal role in fostering a culture of creativity and continuous improvement. By implementing initiatives like training and development programs that encourage knowledge sharing, SMEs can significantly enhance their innovation capabilities. Effective HR management

is thus crucial for driving innovation processes and maintaining competitive advantage in dynamic business environments.

Quantitative studies (Battour et al., 2021; Pahuja et al., 2024; Hamadamin & Atan, 2019) and recent qualitative research (Agustian et al., 2023) have also aligned with the finding that HR strategies positively and directly impact competitive advantage in SMEs ($\beta = 0.265$, $t = 6.727$, $p = 0.000$), supporting H1d.

This give emphasis to the critical role of effective HR practices in establishing and maintaining a competitive advantage. By prioritizing talent acquisition, employee development, and retention, SMEs can foster a skilled and motivated workforce. These strategic HR initiatives bolster organizational capabilities, innovation, and agility, positioning SMEs to excel amidst competitive market dynamics. Additionally, HR strategies positively impact sustainability-oriented innovation in SMEs ($\beta = 0.175$, $t = 5.390$, $p = 0.000$), thereby supporting H1e. According to Peng et al. (2024), strategic HRM practices enhance employee self-efficacy and engagement in green innovation, mediated by self-efficacy. Adomako and Nguyen (2020) found that HR slack promotes sustainable product/process innovations through intangible knowledge resources. Aslam et al. (2023) observed varied effects of HR practices on sustainability innovation, with recruitment and rewards enhancing eco-innovations, contrasting with redeployment's potentially hindering effects. Overall, HR strategies are posited to directly influence sustainability-oriented innovation (SOI) in SMEs.

Dynamic capabilities directly enhance competitive advantage in SMEs by improving their ability to seize opportunities and effectively reconfigure resources. This agility enables SMEs to quickly respond to market changes, innovate, and sustain a competitive edge, especially in dynamic environments. Such capabilities are crucial for leveraging strategic orientation to achieve sustained success, supporting H2a, and aligning with studies by (Mutsvanga, 2021; Ferreira et al., 2020; and Pundziene et al., 2021).

Eikelenboom and de Jong (2019) found that while external integrative capabilities enhance stakeholder collaboration and sustainability performance in SMEs, excessive internal integration can hinder sustainability-oriented innovation (SOI). Ortiz-Avram et al. (2023) propose firms evolve towards systemic sustainability by increasing SOI novelty and stakeholder integration. Yi and Demirel (2023) reveal that internal green capabilities benefit long-term growth, whereas external supply chain integration initially hinders it. Thus, it is hypothesized that dynamic capabilities positively influence SOI in SMEs and this is aligned with the hypothesis H2b.

Research indicates that firm performance directly and positively influences competitive advantage in SMEs. Wanjiru et al. (2019) identified competitive advantage as a mediator between corporate strategies and firm performance, underscoring its significance. Potjanajaruwit (2018) also emphasized technological capability and inter-organizational collaboration as key drivers of competitive advantage in startups, supporting hypothesis H3a.

Moreover, firm performance directly influences sustainability-oriented innovation (SOI) in SMEs. Studies show that firms with high managerial environmental concern can leverage green innovations for profitability (Xue et al., 2019; Bernal-Torres et al., 2023). Green innovation also reduces risk and enhances valuations (Liu,

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2023). Additionally, integrating green innovation with social disclosure further boosts financial performance (Khanchel et al., 2023). These findings support hypothesis H3b that firm performance directly influences SOI in SMEs.

Firm innovation positively and directly influences competitive advantage in SMEs. Research underscores the critical role of innovation portfolios, including product, process, and organizational innovations (Siriram et al., 2023). Lee & Yoo (2019) emphasize dynamic capabilities in seizing opportunities and boosting product innovation. Baláž et al. (2023) highlight the long-term benefits of R&D and innovation capabilities for sustained growth, supporting hypothesis H4a, where firm innovation impacts SME competitive advantage.

Studies consistently show a positive link between a company's innovation culture, capabilities, and its pursuit of sustainability-oriented innovation (SOI) strategies (Rubio-Andrés & Abril, 2023; Jin et al., 2018). Firms with an open, environmentally and socially integrated culture excel in SOI. In social enterprises, SOI includes eco-friendly product designs and process/organizational innovations like stakeholder engagement and sustainable business models (Harsanto et al., 2022), supporting hypothesis H4b that firm innovation directly impacts SOI in SMEs.

Strategic human resource management (SHRM) practices that align with organizational goals help develop dynamic capabilities, enabling SMEs to innovate and adapt to market demands (Ho et al., 2023). Entrepreneurial orientation enhances this relationship, boosting SHRM's role in fostering dynamic capabilities and innovation (Ho et al., 2023). The Resource-Based View (RBV) highlights how intangible resources like digital capabilities and organizational learning contribute to sustained competitive advantages (Wang et al., 2024), supporting hypothesis H5 that HR strategies indirectly influence SME competitive advantage through dynamic capabilities.

Empirical research emphasizes SHRM practices' significant role in enhancing both tangible and intangible firm performance, contributing to competitive advantage (Mohammed et al., 2021). High-performance HRM systems focusing on employee skills, participation, and innovation positively impact firm performance (Nguyen & Dao, 2023). Additionally, talent management and effective recruitment practices further bolster organizational and financial outcomes (Altındağ & Bilaloğlu Aktürk, 2020), supporting hypothesis H6 that HR strategies indirectly influence SME competitive advantage through firm performance.

Wongsansukcharoen & Thaweepaiboonwong (2023) and Nguyen & Dao (2023) demonstrate that innovative HR practices enhance a firm's innovation capabilities, driving competitive advantage through mediation. Similarly, Kijkasiwat et al. (2024) found that corporate governance impacts firm performance via innovation. This suggests that HR strategies indirectly boost SME competitive advantage by fostering innovation strengths, supporting hypothesis H7 that HR strategies influence competitive advantage through firm innovation.

Recent studies by Alenazi & Alanazi (2023) and Subramaniam et al. (2023) highlight that social CRM strengthens sustainable dynamic capabilities, crucial for adapting to market changes and achieving a sustainable competitive advantage. Additionally, e-leadership qualities positively enhance dynamic

capabilities, which in turn boost innovation management. These findings support hypothesis H8 that HR strategies indirectly influence sustainability-oriented innovation (SOI) in SMEs through dynamic capabilities.

Effective HRM practices, such as recruitment, training, and performance assessment, enhance a firm's innovation capabilities and culture (Gede Riana et al., 2020; Rubio-Andrés & Abril, 2023), promoting sustainability-oriented outcomes (Jin, Navare & Lynch, 2018). HR strategies that emphasize high-performance work practices and dynamic capabilities enable agile responses to sustainability challenges (Alenazi & Alanazi, 2023; Subramaniam et al., 2023), with dynamic capabilities mediating their impact on sustainability innovation management. Strategic HRM also fosters knowledge management and innovation performance (Chawla et al., 2022), improving firm performance and capacity for sustainability-focused innovation (Nguyen & Dao, 2023). Thus, HR strategies indirectly influence sustainability-oriented innovation (SOI) in SMEs through firm innovation (H9).

Nguyen and Dao (2023) show that high-performance HRM practices enhance a firm's innovation capabilities, which positively impact firm performance. This indirect relationship highlights the role of HR strategies in fostering innovation capacity, facilitating sustainability-oriented innovation and performance outcomes. Similarly, Chawla et al. (2022) demonstrate that strategic HRM practices sequentially enhance knowledge management and innovation performance, supporting the hypothesis that HR strategies indirectly influence SOI in SMEs through firm performance and innovation capabilities (H10).

RECOMMENDATIONS TO TOP AND MIDDLE MANAGERS

Here are some ways top and middle managers in SMEs (across public, private, and mixed ownership structures) can apply these implications in various sectors in Saudi Arabia: *Adopting High-Performance HRM Practices:* Top managers advocate for high-performance HRM practices like strategic recruitment, training, and performance evaluation, fostering an environment conducive to innovation and employee engagement. Middle managers implement these practices at the operational level, ensuring alignment with organizational goals and promoting professional development and employee empowerment, essential for sustained growth and performance. *Fostering Innovation Capabilities*: Top managers should allocate resources and provide strategic support to foster innovation in product/service development, process improvement, and customer experience. This encourages a culture of innovation within the organization. Middle managers promote cross-functional collaboration and knowledge sharing, creating an environment that stimulates creativity and proactive problem-solving, contributing to continuous improvement and adaptation to market demands. *Developing Sustainable Dynamic Capabilities:* Top managers drive sustainable dynamic capabilities by integrating sustainability into core business strategies and operations, ensuring resilience and adaptability to environmental and market challenges. Middle managers operationalize sustainability practices through efficient resource management, waste reduction initiatives, and sustainable procurement practices, enhancing long-term competitiveness while meeting societal and environmental responsibilities. *Enhancing Competitive Advantage:* Top managers leverage HR strategies to enhance competitive advantage by focusing on superior

customer service, optimizing operational efficiency, and differentiating products/services. Middle managers implement continuous improvement processes and monitor market trends to identify opportunities for innovation and differentiation, strengthening the SME's competitive position by responding effectively to evolving market dynamics and customer preferences. Aligning with Sector-Specific Challenges:

Top managers stay informed about sector-specific challenges and opportunities, such as digital transformation in e-commerce or regulatory changes in manufacturing, guiding strategic decision-making and resource allocation. Middle managers adapt operational strategies to address these challenges, leveraging HRM practices to build resilience and agility, allowing SMEs to capitalize on opportunities and mitigate risks proactively. *Promoting a Culture of Sustainability and Innovation:* Top managers cultivate a culture of sustainability and innovation by setting clear goals, values, and incentives aligned with these principles, fostering employee commitment and organizational alignment. Middle managers lead by example, encouraging teams to contribute sustainability-oriented ideas and facilitating their implementation, promoting a culture of creativity and responsibility. *Monitoring and Measuring Performance:* Top managers establish key performance indicators (KPIs) to monitor the impact of HR strategies on innovation, sustainability, and competitive advantage, ensuring continuous improvement and accountability. Middle managers regularly assess departmental performance against KPIs, providing feedback and making necessary adjustments to optimize outcomes, effectively achieving strategic goals and enhancing overall organizational performance. By applying these strategies effectively, top and middle managers can enhance the resilience, innovation capacity, competitive advantage, and sustainability orientation of SMEs across various ownership structures in Saudi Arabia's diverse sectors.

CONCLUSION

This research highlights the critical role of HR strategies in enhancing competitive advantage and sustainability-oriented innovation in diverse SMEs with varying ownership structures. Its findings can guide managers in aligning HR practices with organizational goals, fostering long-term success. Future research could explore the impact of specific HR strategies across different industries, delve deeper into the relationship between HR practices and employee well-being, or investigate how digital transformation influences HR strategy effectiveness in SMEs. Such extensions could provide valuable insights for both academia and industry practitioners.

Conflict of interests

The authors declare no conflict of interest.

Author Contributions:

Conceptualization, M. P and A.T.R.; methodology, M. P; software, M. P; validation, M. P. and A.T.R; formal analysis, M.P; investigation, M.P and A.T.R.; resources, M.P.; data curation, M.P and A.T.R.; writing— original draft preparation, M.P. and A.T.R; writing—review and editing, M. P and A.T.R.; supervision, M.P and A.T.R.; project administration, M.P and A.T.R.; funding acquisition, A.T.R.

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The data presented in this study are available on request from the corresponding author.

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About the authors

Abrar Talal RIZQ,

Ph.D., Assistant Professor, Department of Human Resource Management, Faculty of Economics and Administration; director of the Executive MBA Program, King Abdulaziz University, Jeddah, Saudi Arabia.

Research interests: HR practices, organizational behavior, leadership in entrepreneurial ecosystems.

ORCID: 0009-0009-0893-7168

Musrrat PARVEEN,

Ph.D., Associate Professor, Department of Human Resource Management, Faculty of Economics and Administration, King Abdulaziz University, Jeddah, Saudi Arabia.

Research interests: HRM, leadership, entrepreneurship, organizational behavior, AI, and women studies.

ORCID: 0000-0002-3796-8061

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