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The Impact of Human Resource Management Factors on Business Sustainability in the Manufacturing Sector: A Comparative Study of SMEs in the Visegrad Four Countries

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Abstract: This study aims to develop a model of sustainable business performance within small and medium-sized enterprises (SMEs) in the manufacturing sector, with a particular focus on Human Resource Management (HRM) factors, and to compare this model across different sectors, namely manufacturing, trade, and services. The empirical research was conducted in February 2024 across the Visegrad Four (V4) countries—Czech Republic, Slovakia, Poland, and Hungary. Data collection was managed by the European Centre for Economic and Social Research through a Computer-Assisted Web Interviewing (CAWI) method, using a survey questionnaire designed by the research team. Linear regression modeling (LRM) was employed to test the proposed hypotheses. The findings reveal that a participative management style and a high-quality employee appraisal system were identified as significant factors influencing business sustainability within the manufacturing sector. Additionally, career growth planning, employee satisfaction, and low turnover rates were found to have positive effects on sustainability. When comparing the models across the sectors, the research highlighted significant sectoral differences. In the trade sector, all HRM factors were found to be influential, whereas, in the manufacturing sector, only the factors related to participative management style (x1), employee appraisal quality (x2), and career growth planning (x4) showed significant effects. The least significant impact of HRM factors on business sustainability was observed in the services sector, where only two factors (x2 and x4) were significant. Notably, differences were observed in the significance of certain factors across the sectors: while factor x2 (employee appraisal quality) was crucial in the manufacturing sector, it was insignificant in the services sector. Conversely, factor x3 (employee satisfaction) showed no significant effect in the manufacturing sector but was significant in the trade sector. These findings underscore the importance of adapting HRM practices to the specific characteristics of each sector in order to enhance sustainability. The study highlights the necessity for tailored HRM strategies that align with the sector-specific dynamics of SMEs to promote long-term business sustainability.

Keywords: Human Resource Management (HRM); Sustainability; Manufacturing industry

1. Introduction

The sustainability of SMEs in the V4 countries (Czech Republic, Hungary, Poland, and Slovakia) is an increasingly debated topic, particularly in the context of global environmental challenges and economic transformation (Khan et al., 2023). SMEs play a crucial role in these economies, contributing significantly to employment, innovation, and GDP. Given their size and resource constraints, achieving sustainability for SMEs, particularly in the manufacturing sector, is both critical and challenging.

The manufacturing sector is especially pivotal to sustainability discussions due to its intensive use of resources, energy consumption, and environmental impact. SMEs in manufacturing face unique challenges compared to those in trade and services, such as higher material usage, waste production, and the need for energy-efficient technologies. However, these challenges also present opportunities for implementing innovative solutions, such as adopting cleaner technologies and more efficient production processes, which can reduce costs and improve

competitiveness. Effective HRM practices in manufacturing SMEs are essential for navigating these challenges, as they ensure that employees are equipped with the skills needed to implement and sustain green practices.

The Environmental, Social, and Governance (ESG) concept defines standards that are gradually becoming mandatory for businesses. The ESG framework is increasingly utilized to assess firm performance, guide investment decisions, and inform consumer purchasing behavior (Agnese et al., 2023; Asif et al., 2023; Katsamakas & Sanchez-Cartas, 2023; Nielsen & Villadsen, 2023; Sahin et al., 2023). The primary objective of the ESG concept is the long-term sustainability of enterprises (Chung et al., 2023; Edmans, 2023; Fu & Li, 2023; Kanno, 2023; Tan et al., 2023).

Unique Challenges and Opportunities for Manufacturing SMEs

Manufacturing SMEs face several specific challenges in adopting sustainability and effective HRM practices. These include limited financial resources, a lack of technical expertise, and difficulties in integrating sustainable practices into existing production processes. Moreover, manufacturing involves more complex supply chains, greater regulatory pressures related to emissions and waste, and the need for advanced technologies to remain competitive. However, manufacturing SMEs also have significant opportunities to enhance sustainability through process innovation, green technologies, and workforce development. Implementing sustainable practices not only reduces environmental impact but also improves efficiency, lowers production costs, and enhances brand reputation.

Rationale for Sector Comparison

This article compares the manufacturing sector to the trade and services sectors to illustrate the distinct HRM challenges and opportunities that arise due to the nature of each sector's operations. Manufacturing SMEs typically require a higher degree of technical expertise, specialized training, and safety management compared to trade and services, where customer interaction, sales skills, and service quality are prioritized. These differences in operational demands translate into varying HRM approaches, such as the need for continuous upskilling in manufacturing versus customer service training in the trade and services sectors.

In the manufacturing sector, HRM practices focus on equipping employees with skills for digital tools, sustainability practices, and safety compliance. In contrast, HRM in trade and services sectors often emphasizes communication skills, customer relations, and sales techniques. Understanding these differences is critical for tailoring HRM strategies that effectively support sustainability across sectors. For instance, Gallo et al. (2023) emphasize that models like the Balanced Scorecard (BSC) and the European Foundation for Quality Management (EFQM) are valuable for enhancing performance by aligning HRM with strategic objectives.

Digitalization, Industry 4.0, and HRM in Manufacturing

Digitalization and Industry 4.0 are transforming the manufacturing sector by integrating advanced technologies such as the Internet of Things (IoT), artificial intelligence (AI), digital twins, simulations, and big data analytics. These technologies allow SMEs to optimize production processes, reduce waste, and improve product quality (Etienne Fabian et al., 2024; Holl & Rama, 2024). Digital manufacturing enables automation, real-time monitoring, and predictive maintenance, which are critical for enhancing efficiency and sustainability. Companies can respond more swiftly to market changes and customer demands, fostering agility in dynamic environments (Wang et al., 2016).

However, the successful implementation of digitalization relies heavily on HRM practices. Employees need training to adapt to new technologies and workflows, making HRM a key enabler of digital transformation. HRM strategies must focus on upskilling, reskilling, and promoting a culture of continuous learning. Effective HRM can address concerns related to digitalization, such as resistance to change, skill gaps, and management style adaptations (Tick et al., 2022).

Moreover, digital manufacturing contributes to sustainability by improving resource efficiency, reducing energy consumption, and minimizing waste. For SMEs, adopting digital technologies not only supports environmental goals but also enhances their market competitiveness. Nevertheless, challenges such as high implementation costs, limited access to capital, and knowledge barriers still hinder the widespread adoption of digital manufacturing among SMEs.

The sustainability of SMEs in the V4 countries, particularly in the manufacturing sector, depends on the effective integration of HRM practices, digitalization, and ESG standards. By addressing the unique challenges faced by manufacturing SMEs and leveraging the opportunities presented by Industry 4.0, these firms can achieve long-term sustainability and competitiveness. Comparing HRM approaches across manufacturing, trade, and services sectors provides valuable insights for developing sector-specific strategies that support sustainable development.

2. Theoretical Background

Each sector possesses unique characteristics that influence strategies, process management, business policies, HRM practices, and other areas of corporate governance.

The manufacturing sector focuses on the production of tangible goods. Processes are often mechanised and

automated, utilising advanced technologies such as CNC machines and robotics (Heizer et al., 2020). A crucial aspect of manufacturing is the storage of raw materials and finished products, with effective inventory management being essential for cost minimisation and productivity maximisation (Belas et al., 2018). Ensuring high product quality, including testing and certification, is critical for customer satisfaction and compliance with standards. Digitalisation and the implementation of advanced technologies such as the IoT and digital twins enable optimisation of manufacturing processes and increased efficiency (Kagermann et al., 2013).

The trade sector emphasises the sale of products or services and customer satisfaction. Understanding market needs is pivotal to success (Kottler & Keller, 2009). Consequently, strong emphasis is placed on marketing strategies, brand building, and customer relationship management (Baker, 2017). Efficient product distribution, including logistics and supply chain management, is fundamental to trading operations (Christopher, 2016). Business activities in this sector are often affected by seasonal trends and shifting consumer preferences, requiring firms to adopt flexible and adaptive strategies.

Services, by nature, are intangible and cannot be physically owned or stored. Their value is created through interactions and experiences (Zeithaml et al., 2018). Services are often delivered directly to customers through online processes, necessitating high levels of communication and interpersonal skills among employees (Wirtz & Lovelock, 2021). Service quality can be variable, depending on factors such as staff, the environment, and the mode of delivery. The ability to quickly respond to customer needs and tailor services accordingly is key to success in this sector (Belas et al., 2018).

Each sector's distinct characteristics shape its practices and strategies. Successful businesses must adapt to these specifics to achieve competitiveness and efficiency.

HRM varies logically across sectors, with manufacturing, trade, and services each requiring tailored approaches.

In the manufacturing sector, HRM often focuses on process optimisation and efficiency. Employees frequently perform repetitive tasks, necessitating robust training on machinery operation and new technologies. Safety standards and regulations play a critical role, as employee physical safety is a top priority. According to Dessler (2017), the manufacturing sector prioritises quality and productivity, demanding precise workforce planning and performance management.

In the trade sector, HRM is oriented towards sales skills and customer service. Employees must excel in communication and negotiation, requiring a distinct approach to recruitment and training. Motivating sales personnel through commissions and bonuses is a common practice in this sector, differing significantly from other industries (Boxall & Purcell, 2016).

The service sector's HRM centres on customer interaction and service quality. Employees often work directly with customers, highlighting the importance of communication skills and emotional intelligence. Staff performance in this sector is frequently assessed based on customer satisfaction, which can lead to high employee turnover (Grönroos, 2007). Consequently, specialised recruitment, training, and retention strategies are essential.

While manufacturing focuses on efficiency and safety, trade emphasises sales and motivation, and services prioritise customer satisfaction and engagement. These differences necessitate customised HRM strategies to achieve sector-specific objectives.

Despite sectoral differences, universal HRM tools—such as effective leadership, career development opportunities, employee care, and satisfaction—can be applied across industries.

The impact of HRM factors on the sustainability of SMEs is a multifaceted topic, requiring a multidimensional approach that incorporates various HRM practices and their influence on the long-term viability of organisations. Sustainability in SMEs encompasses not only economic but also environmental and social dimensions, which are interlinked and shaped by HRM processes and strategies.

In recent years, significant attention has been directed toward green human resource management (GHRM) and other HRM approaches aimed at organisational sustainability. Key goals include employee engagement, career growth, organisational culture, and knowledge management.

A careful HRM system, as outlined in the model by Saks (2022), can foster a workplace climate centred on employee well-being. This approach enhances employee engagement, motivating them to contribute to organisational goals. Engaged employees are not only more productive but also more invested in achieving the organisation's long-term sustainability. Findings from Alsafadi & Altahat (2021) suggest that effective HRM practices positively impact employee performance and satisfaction, leading to greater job stability and task enrichment, which contribute to overall organisational development.

The growing emphasis on GHRM practices is critical for evaluating the environmental sustainability of organisations. According to Adu Sarfo et al. (2024), implementing GHRM fosters environmentally responsible employee behaviours through initiatives like Green Employee Empowerment (GEE), which facilitates achieving environmental goals more effectively. GHRM is thus recognised as an effective tool for supporting environmental initiatives, as employees motivated by green HRM practices are more proactive in adopting eco-innovations and sustainable practices.

Beyond environmental aspects, other dimensions of sustainability, such as economic and social sustainability, are also influenced by HRM systems. Research by Al Koliby et al. (2024) indicates that environmental strategies

in HRM positively affect knowledge management and sustainable performance in SMEs, with knowledge management serving as a mediator between environmental strategies and organisational performance. The ability of SMEs to manage and leverage knowledge is crucial for their competitiveness and sustainability, particularly in rapidly changing market conditions and technological advancements.

Studies by Wang & Makhbul (2024) highlight the importance of transformational leadership in promoting environmental initiatives in SMEs. Transformational leadership plays a key role in implementing sustainable practices by inspiring employee engagement and innovation that contribute to environmental and social sustainability. Support for environmental innovation from management creates a multiplier effect, expanding these strategies and leading to long-term improvements in environmental performance.

Similarly, other research by Achmad & Wiratmadja (2024) underscores the role of frugal innovation, supported by sustainable leadership, dynamic capabilities, and knowledge management, in significantly improving SME sustainability performance. Frugal innovation is vital for SMEs facing challenges associated with transitioning to sustainable business models.

Given the increasing pressure on SMEs to innovate and adopt sustainable practices, organisations must implement modern technological approaches, such as Industry 4.0. Kumar & Sharma (2024) highlight the pivotal role of HR training programmes and top management commitment in the successful implementation of Industry 4.0 in SMEs, contributing to sustainable development. This research identifies key dimensions, including commitment, strategic collaboration, and stakeholder coordination, as critical for successfully adopting technological innovations and achieving sustainability.

The role of GHRM is significant, as reported in the study by Khamdamov et al. (2023) and Perez et al. (2023), which focus on the impact of green HRM practices on firms' environmental performance. According to these studies, the implementation of green transformational leadership and GHRM leads to a higher level of environmental behaviors of employees, which has a direct impact on improving the environmental performance of organizations. Green innovations that are supported by these approaches enhance the environmental performance of firms, thereby contributing to the long-term sustainability of organizations.

In summary, effective HRM practices, as well as green and friendly innovation approaches, are key to ensuring sustainability in SMEs. According to Shao et al. (2024), green talent management advances green core competencies, expands a company's commitment to Corporate Social Responsibility, and strengthens the link between green talent management and environmental performance. The same view is shared by Gyensare et al. (2024) who argue that green HRM practices have a positive impact on the mechanism of green employee behaviour. A similar view is also held by Elshaer et al. (2023), whose results suggest that green HRM practices are positively related to individual green values and job satisfaction. Organizations need to develop not only economic but also environmental dimensions that play an important role in implementing sustainable business practices. Educating employees, fostering commitment and encouraging innovation are prerequisites for the long-term success and sustainable development of SMEs.

This article investigates the dependence of sustainable growth (SG) on key HRM factors in the manufacturing sector of V4 countries. The research compares the attitudes of owners and managers of manufacturing firms with those of respondents in the trade and service sectors, aiming to identify common traits and sectoral differences. By examining these relationships, the study contributes to a deeper understanding of how HRM practices can drive sustainability in SMEs across various industries.

3. Methodology

The objective of this research was to create a model illustrating the relationship between sustainable business practices and HRM factors within the SME segment of the manufacturing sector, and to contrast this model with findings from other industries.

The empirical study, targeting the perceptions of SMEs, took place in February 2024 across the Visegrád Group (V4) countries, specifically the Czech Republic, Slovakia, Poland, and Hungary. The European Centre for Economic and Social Research conducted the data collection process using the CAWI method and a questionnaire designed by the research team. The questionnaire was intended to be completed by either the SME owner or a senior manager, referred to collectively as the respondent.

The total number of respondents from the V4 countries was 742. The response rate was 24%. The nationality structure of respondents was as follows: 192 (25.88%) from the Czech Republic, 170 (22.91%) from Hungary, 191 (25.74%) from Poland, and 189 (25.47%) from Slovakia. In terms of roles, 561 (53.13%) were business owners, and 495 (46.88%) were senior managers. The size structure of the firms was as follows: 374 (50.40%) micro-enterprises, 205 (27.63%) small enterprises, and 163 (21.97%) medium-sized enterprises. The legal forms of enterprises were distributed as follows: 317 (42.72%) sole proprietorships, 296 (39.89%) limited liability companies, 58 (7.82%) joint-stock companies, and 71 (9.57%) respondents indicated other forms of business. Sectorally, 388 respondents (52.29%) operated in services, 207 (27.90%) in trade, and 147 (19.81%) in manufacturing. Firms were categorized into the manufacturing, trade, and services sectors based on their primary

economic activity as defined by the European Statistical Classification of Economic Activities (NACE). The sector classification of the company was determined by the respondent itself. Regarding the duration of business operations, 250 respondents (33.69%) reported operating for up to five years, 227 (30.59%) for more than five years but less than ten years, and 265 (35.72%) for more than ten years. The gender distribution of respondents was 391 (52.70%) men and 351 (47.30%) women.

Potential biases and limitations were considered, such as self-reporting bias, where owners and managers may overstate or understate their sustainable practices and HRM approaches. The sectoral distribution also posed a limitation, with the manufacturing sector having fewer respondents (147) compared to services (388) and trade (207). Additionally, geographical representation, although balanced across the V4 countries, may still reflect regional economic disparities that influence attitudes toward sustainability.

Based on qualitative research, the following independent and dependent variables were carefully chosen based on literature that underscores their relevance to manufacturing SMEs' unique challenges and opportunities. These factors collectively address process efficiency, workforce development, employee well-being, and retention, all of which are critical for achieving long-term sustainability in a sector undergoing digital transformation and facing increasing environmental pressures.

Dependent Variable (y):

• y: Sustainable growth should address not only the economic interests of firms but also positive impacts on the social system and environmental aspects. This perspective is applied in daily business activities.

Independent Variables (x1–x4):

• x1: We apply a participative management system in the company. We have developed a high-quality employee appraisal system with material incentives. (Boxall & Purcell, 2016; Dessler, 2017).

• x2: We have plans to enhance the qualifications of our employees and ensure their career growth within the company (Belas et al., 2018; Kumar & Sharma, 2024).

• x3: We provide our employees with various corporate benefits (e.g., recreational opportunities, social insurance bonuses, company events, sports activities, cultural events, etc.) **(**Grönroos, 2007; Saks, 2022).

• x4: We ensure that our employees are satisfied within the company and do not leave. The annual employee turnover rate is below 10% **(**Adu Sarfo et al., 2024; Alsafadi & Altahat, 2021).

To identify relationships between variables, correlation analysis was applied. LRM was then used to assess the impact of specific HRM factors. Given the nature of the data, which employed a Likert scale and approximated interval-level measurement, this method proved suitable due to its assumption of linearity. Regression analysis was conducted to test the research hypotheses at a 5% significance level ($\alpha = 0.05$). LRM enabled the linear scaling of responses in the quantitative study, which utilized a 1-to-5 Likert scale. This approach was selected because it facilitates the quantification of the influence of several independent variables on one dependent variable.

It was hypothesised that positive responses to the independent variables (x1–x4) would correspond to positive perceptions of the dependent variable (y). This approach aimed to assess the relationship between the dependent variable (y) and the independent variables (x1–x4) based on the statements provided, focusing on SMEs within the Visegrád Group (V4) countries. Additionally, multicollinearity was evaluated using the Variance Inflation Factor (VIF). ANOVA was employed to determine the differences in SMEs' perspectives on SG across sectors.

The following hypotheses were defined in the research (Hypotheses 2–5 are presented in aggregated form):

• H1: There is a significant difference in SMEs' perceptions of SG based on the sector.

• H2: SMEs' perceptions of sustainable growth are significantly influenced by the application of a participative management system.

H2a: There are differences between the manufacturing sector and the trade and service sectors.

• H3: SMEs' perceptions of sustainable growth are significantly influenced by ensuring employee career development.

H3a: There are differences between the manufacturing sector and the trade and service sectors.

• H4: SMEs' perceptions of sustainable growth are significantly influenced by the provision of employee benefits.

H4a: There are differences between the manufacturing sector and the trade and service sectors.

• H5: SMEs' perceptions of sustainable growth are significantly influenced by the rate of employee turnover.

H5a: There are differences between the manufacturing sector and the trade and service sectors.

4. Results

The Results section may be divided into subsections. It should describe the results concisely and precisely, provide their interpretation, and draw possible conclusions from the results.

Based on descriptive analysis (kurtosis and skewness), which is in the range of <-2;2>, the data are normally distributed. It is possible to proceed with ANOVA calculations, correlation and regression analysis (Table 1).

Based on the ANOVA results (Fisher test = 1.866, p-value = 0.155), it can be concluded that the sector under study (manufacturing, services, or trade) does not have a statistically significant effect on the perception of SG.

Therefore, Hypothesis H1 is rejected (Table 2).

Table 1. Descriptive statistics

	y	x1	x2	x3	x4
Mean	1.9892	2.0809	2.0458	2.1712	2.0566
Standard Error	0.0326	0.0354	0.0336	0.0365	0.0356
Standard Deviation	0.8877	0.9630	0.9165	0.9948	0.9703
Sample Variance	0.7880	0.9273	0.8400	0.9896	0.9415
Kurtosis	0.7529	0.3096	0.8723	0.1462	0.4096
Skewness	0.8451	0.7560	0.8584	0.6911	0.8198

Source: Own calculation

Table 2. Anova for H1

ANOVA – H1					
Cases	**Sum of Squares**	**df**	**Mean Square**	**F**	**p**
Sectors	2.934	2	1.467	1.866	0.155
Residuals	580.980	739	0.786		

Source: Own calculation

4.1 Manufacturing

The results of the correlation analysis, conducted at a significance level of $\alpha = 0.05$, indicate a strong positive relationship between SMEs' perception of SG in the manufacturing sector and the factors x1 to x4. The correlation coefficients for y (x1-x4) fall within the range c = < 0.612; 0.707 > (Table 3).

Table 3. Linear regression – manufacturing

Pearson's Correlations					
Variable	**y**	**x1**	**x2**	**x3**	**x4**
y	—				
x1	0.624	—			
x2	0.707	0.719	—		
x3	0.615	0.664	0.753	—	
x4	0.612	0.590	0.721	0.655	—

Model Summary - y							
Model	**R**	**R^2**	**Adjusted R^2**	**RMSE**	**Durbin-Watson Autocorrelation**	**Durbin-Watson Statistic**	**p**
MAN	0.956	0.915	0.912	0.617	0.084	1.814	0.262

ANOVA						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**p**
MAN	Regression	582.627	4	145.657	383.072	< .001
	Residual	54.373	143	0.380		
	Total	637.000	147			

Coefficients								
Model		**Unstd.**	**Std. Error**	**Std.**	**t**	**p**	**Collinearity Tolerance**	**Collinearity VIF**
Intercept		0.337	0.115		2.926	0.004		
H2M	x1	0.236	0.083	0.240	2.862	0.005	0.445	2.247
H3M	x2	0.416	0.106	0.412	3.920	< .001	0.294	3.397
H4M	x3	0.124	0.087	0.131	1.429	0.155	0.383	2.610
H5M	x4	0.172	0.076	0.192	2.256	0.026	0.448	2.235

Source: Own calculation

The outcomes of the linear regression analysis for the manufacturing sector revealed that over 91% of the variation in the perception of SG (Adj. $R^2 = 0.912$) can be attributed to factors x1 (coefficient = 0.236, p-value = 0.005), x2 (coefficient = 0.416, p-value < 0.001), and x4 (coefficient = 0.172, p-value = 0.026). The regression model itself is statistically significant (p-value < 0.0001). In contrast, the models for other sectors did not reach statistical significance. The Variance Inflation Factor (VIF) calculation, performed to detect multicollinearity, indicated a moderate correlation among the independent variables (1 < VIF < 5).

The regression model for the manufacturing sector is as follows:

$$y = 0.337 + 0.236x1 + 0.416x2 + 0.124x3 + 0.172x4$$

4.2 Trade

The results of the correlation analysis, conducted at a significance level of α = 0.05, reveal that SMEs' perception of SG in the trade sector is moderately positively correlated with factor x4 (c = 0.560) and strongly positively correlated with factors x1 to x3 (c = < 0.619; 0.652 >) (Table 4).

Table 4. Linear regression – trade

Pearson's Correlations					
Variable	**y**	**x1**	**x2**	**x3**	**x4**
y	—				
x1	0.639	—			
x2	0.652	0.697	—		
x3	0.619	0.629	0.748	—	
x4	0.560	0.470	0.594	0.601	—

Model Summary - y							
Model	**R**	**R²**	**Adjusted R²**	**RMSE**	**Durbin-Watson Autocorrelation**	**Durbin-Watson Statistic**	**p**
TRD	0.732	0.536	0.527	0.617	0.046	1.875	0.362

ANOVA						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**p**
TRD	Regression	88.888	4	22.222	58.447	< .001
	Residual	76.803	202	0.380		
	Total	165.691	206			

Coefficients								
Model		**Unstd.**	**Std. Error**	**Std.**	**t**	**p**	**Collinearity Tolerance**	**VIF**
	Intercept	0.337	0.115		2.926	0.004		
H2T	x1	0.286	0.065	0.304	4.434	<.001	0.487	2.053
H3T	x2	0.204	0.082	0.206	2.490	0.014	0.336	2.975
H4T	x3	0.136	0.069	0.152	1.969	0.050	0.385	2.594
H5T	x4	0.184	0.056	0.203	3.262	0.001	0.591	1.692

Source: Own calculation

The findings from the linear regression analysis for the trade sector indicated that more than 52% of the variation in the perception of SG (Adj. R^2 = 0.527) is explained by all the factors examined (x1 through x4), with a coefficient of 0.236 and a p-value of 0.005. The overall regression model was statistically significant (p-value < 0.0001). In contrast, the models for other sectors did not achieve statistical significance. The assessment of multicollinearity using the Variance Inflation Factor (VIF) showed moderate correlations among the independent variables, with VIF values falling between 1 and 5.

The regression model for trade is as follows:

$$y = 0.337 + 0.286x1 + 0.204x2 + 0.136x3 + 0.184x4$$

4.3 Services

The results of the correlation analysis, conducted at a significance level of α = 0.05, indicate that SMEs' perception of SG in the service sector is strongly positively correlated with factor x1 (c = 0.600) and moderately positively correlated with factors x2 to x4 (c = < 0.529; 0.571 >) (Table 5).

The linear regression analysis for the services sector demonstrated that 42% of the variation in the perception of SG (Adj. R^2 = 0.420) is influenced by factors x1 and x4, with coefficients of 0.315 (p-value < 0.001) and 0.260 (p-value < 0.001), respectively (Table 6). This regression model was statistically significant (p-value < 0.001). The models for the other sectors did not show statistical significance. The multicollinearity check using the VIF indicated moderate correlations between the independent variables, with VIF values ranging between 1 and 5.

Table 5. Linear regression – services

Pearson's Correlations					
Variable	**y**	**x1**	**x2**	**x3**	**x4**
y	—				
x1	0.600	—			
x2	0.529	0.772	—		
x3	0.550	0.729	0.747	—	
x4	0.571	0.631	0.661	0.682	—

Model Summary - y							
Model	**R**	**R^2**	**Adjusted R^2**	**RMSE**	**Durbin-Watson Autocorrelation**	**Durbin-Watson Statistic**	**p**
SER	0.652	0.426	0.420	0.671	-0.050	2.092	0.367

ANOVA						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**p**
SER	Regression	127.809	4	31.952	70.965	< .001
	Residual	172.446	383	0.450		
	Total	300.255	387			

Coefficients								
Model		**Unstd.**	**Std. Error**	**Std.**	**t**	**p**	**Collinearity Tolerance**	**VIF**
	Intercept	0.600	0.094		6.398	< .001		
H2S	x1	0.315	0.060	0.349	5.297	< .001	0.345	2.900
H3S	x2	-0.008	0.065	-0.009	-0.124	0.901	0.316	3.160
H4S	x3	0.096	0.058	0.109	1.658	0.098	0.346	2.892
H5S	x4	0.260	0.052	0.281	5.003	< .001	0.474	2.110

Source: Own calculation

The regression model for the trade sector is as follows:

$$y = 0.315 + 0.286x1 + 0.204x2 + 0.136x3 + 0.184x4$$

Table 6. Hypotheses overview

	H1	**H2**	**H2a**	**H3**	**H3a**	**H4**	**H4a**	**H5**	**H5a**
Manufacturing		A		A		R		A	
Trade	R	A	R*	A	R*	A	A*	A	R*
Services		A	R**	R	A**	R	R**	A	R**

Note: A-accepted, R-rejected. * represents a comparison of the manufacturing sector with the trade sector, ** represents a comparison of the manufacturing sector with the service sector.
Source: own calculation

In manufacturing, encouraging employees to participate in decision-making and recognizing their contributions through performance evaluations and incentives can enhance engagement and support sustainable practices. This is critical for maintaining productivity and operational efficiency. Investing in continuous training and skill development is crucial for manufacturing SMEs, particularly given the need to adopt Industry 4.0 technologies. This helps employees adapt to new processes, improving both efficiency and sustainability outcomes. Maintaining a stable workforce through job satisfaction initiatives reduces turnover costs and supports long-term operational efficiency. Effective retention strategies help sustain knowledge and expertise within the firm.

Manufacturing SMEs rely on technical skills, process optimization, and operational efficiency. Therefore, continuous upskilling and involving employees in decision-making are critical for adopting sustainable practices and new technologies. Trade SMEs prioritize customer service and sales efficiency. Effective management practices, motivated employees, and job satisfaction are essential for sustaining performance in a dynamic market influenced by consumer trends. Services rely heavily on customer interactions and employee engagement. Communication, emotional intelligence, and satisfaction drive service quality and sustainability, making participative leadership and retention strategies key.

5. Discussion

Based on the results of the ANOVA, it was determined that a firm's sector affiliation does not have a statistically

significant impact on the overall perception of SG. This indicates that firms in manufacturing, trade, and services evaluate SG similarly, regardless of their sectoral focus. Hypothesis H1 was therefore rejected.

In the manufacturing sector, the perception of SG was found to be strongly and positively influenced by factors x1 to x4, as confirmed by correlation analysis (c = <0.612; 0.707>). The most significant factors identified through linear regression modelling are:

- x1: Implementation of a participative management system, including a high-quality employee appraisal and material incentive system.
- x2: Plans to enhance employee qualifications and ensure career growth within the company.
- x4: Efforts to maintain employee satisfaction and reduce turnover.

These factors together explain over 91% of the variability (Adj. R Sqr = 0.912) in the perception of SG. Factor x3 (employee benefits) was found to be statistically insignificant, which may suggest that benefits do not directly influence the perception of SG in this sector.

In the trade sector, the perception of SG showed a moderately positive dependence on factor x4 and a strongly positive dependence on factors x1 to x3. Regression analysis revealed that all four factors (x1 to x4) significantly influence the perception of SG, collectively explaining more than 52% of the variability. This result indicates that trade firms perceive SG holistically, valuing a balanced approach to management, employee development, and satisfaction.

In the services sector, factor x1 demonstrated a strong positive impact, while factors x2 to x4 showed a moderately positive influence. Linear regression modelling identified the key factors influencing the perception of SG as:

- x1: Participative management and employee appraisal system.
- x4: Efforts to ensure employee satisfaction.

These factors explain 42% of the variability (Adj. R Sqr = 0.420) in the perception of SG in this sector. Other factors were found to be statistically insignificant, suggesting that firms in the service sector place greater emphasis on employee satisfaction and active participation in management.

The analysis results indicate that the role of factors x1 to x4 in influencing SG perceptions varies across sectors. The findings confirmed differences in the intensity of the effects of factors x2 and x3, which significantly distinguish the manufacturing sector from the trade and service sectors. While the influence of x2 is significant in the manufacturing sector, it is not significant in the service sector. Similar results were observed for factor x3, which is insignificant in the manufacturing sector but significant in the trade sector.

Firms in different sectors should consider their industry's specific characteristics when implementing SG strategies. In manufacturing, the focus should be on career growth and employee satisfaction, while trade requires a comprehensive approach, and services emphasise employee satisfaction and participative management.

This study contributes to the growing literature on the relationship between HRM practices and sustainability in SMEs, particularly in the manufacturing sector. The findings underscore that HRM factors such as participative management, employee development, and retention play a crucial role in fostering SG. These results align with theories emphasizing the importance of Human Capital Development (Dessler, 2017) and GHRM (Adu Sarfo et al., 2024). The study highlights that for manufacturing SMEs, sustainability is deeply intertwined with technological adaptation and process efficiency.

The findings also reinforce the concept that sector-specific dynamics necessitate tailored HRM strategies. While participative management and employee qualification enhancement were key drivers in manufacturing, other sectors like trade and services emphasized factors such as sales incentives and customer satisfaction. This supports the theoretical framework of contingency theory in HRM, which posits that HRM practices must align with the specific context and characteristics of the industry.

The research findings confirmed the importance of precise workforce planning and performance management in the manufacturing sector, as highlighted by Dessler (2017). This aligns with the findings of Saks (2022) and Alsafadi & Altahat (2021) who emphasise the importance of employee care and the adoption of appropriate HRM practices to enhance employee engagement, which translates into higher performance through increased motivation and commitment to the firm.

These results also support the conclusions of Wang & Makhbul (2024), who highlight the role of transformational leadership in the implementation of sustainable practices within firms. In this context, Zhu & Huang (2023) assert that transformational leadership positively influences a firm's ESG performance. According to the authors, organisational innovations mediate the relationship between transformational leadership and corporate ESG performance. ESG performance is determined by several factors, including the utilisation of digital resources, the adoption of new technologies, and appropriate managerial practices (Wang & Esperança, 2023).

According to Yusliza et al. (2021), the manufacturing industry should pay significantly greater attention to GHRM practices, as employees may perceive these as a reciprocal process. This perception helps firms increase employee engagement levels and reduce voluntary turnover rates.

Managers should ensure that HRM practices, such as training, participative management, and retention programs, are aligned with the company's sustainability objectives. Given the significant impact of employee

qualification enhancement on sustainability (x2), investing in upskilling programs for advanced manufacturing technologies like Industry 4.0 can improve both efficiency and sustainability outcomes. Participative management systems (x1) improve decision-making and innovation, which are crucial for adapting to sustainable practices. Engaging employees in sustainability initiatives can lead to more innovative and efficient processes. Retaining skilled employees (x4) minimizes disruptions and maintains institutional knowledge, which is essential for consistent implementation of sustainable practices.

6. Conclusions

The aim of the research was to develop a model of the dependence of sustainable business practices in the SME segment on defined HRM factors in the manufacturing sector and to compare this model with other industries.

The developed model confirmed that the sustainability of firms in the manufacturing sector is significantly influenced by factors x1, x2, and x4. It can thus be concluded that a participative management style and a high-quality employee appraisal system significantly affect the sustainability of firms. Additionally, career growth planning, employee satisfaction, and low turnover rates positively impact the sustainability of firms in this sector. It is somewhat surprising that providing employee benefits does not influence the sustainability of firms in the manufacturing sector.

The research demonstrated that the defined factors positively affect the sustainability of firms across the evaluated sectors. In the trade sector, all defined HRM factors proved influential, while in the manufacturing sector, factors x1, x2, and x4 were significant. The lowest impact of HRM factors on the sustainability of firms was observed in the services sector, where only two factors were significant.

The research confirmed that partial differences exist between the model for the manufacturing sector and the models for the other two sectors. While factor x2 is a significant component of the model in the manufacturing sector, it is not significant in the services sector. Conversely, while factor x3 is insignificant in the manufacturing sector, it is significant in the trade sector.

The research results highlighted the importance of applying appropriate HRM practices in the context of firm sustainability and emphasised the need for HRM to adapt flexibly to the specific characteristics of the businesses under study.

This research is limited by its regional scope, as it was conducted only in the V4 countries. Nevertheless, it can be assumed that it provides partial scientific insights that may serve as inspiration for further research. The study focuses on a specific set of HRM factors. Other factors (e.g., leadership style, organizational culture) could also play significant roles in SG but were not included in the model. By acknowledging these limitations, future research can aim to address these gaps, such as increasing sample sizes, diversifying data collection methods, and exploring additional HRM factors.

Future research could investigate how leadership style, organizational culture, and employee engagement mediate the relationship between HRM practices and sustainability. Understanding these factors can provide a more comprehensive model of sustainability in SMEs. Comparing micro, small, and medium-sized enterprises could reveal how firm size influences the effectiveness of HRM practices in promoting sustainability. Smaller firms may face different constraints and opportunities compared to larger SMEs. Future research could explore how the adoption of Industry 4.0 technologies influences HRM practices and sustainability outcomes. Understanding the interplay between digital transformation and HRM can inform strategies for managing workforce transitions.

Author Contributions

Conceptualization, J.B.; methodology, J.B. & Z.M.; software, Z.M.; validation, Z.M; formal analysis, A.H.; investigation, J.B. & Z.M.; resources, A.H. & J.B.; data curation, J.B. & Z.M.; writing—original draft preparation, J.B., Z.M. & A.H.; writing—review and editing, Z.M.; visualization, Z.M.; supervision, J.B.

Data Availability

The data supporting our research results are included within the article or supplementary material.

Conflicts of Interest

The authors declare no conflict of interest.

References

Achmad, F. & Wiratmadja, I. I. (2024). Driving sustainable performance in SMEs through frugal innovation: The

nexus of sustainable leadership, knowledge management, and dynamic capabilities. *IEEE Access*, *12*, 103329-103347. https://doi.org/10.1109/ACCESS.2024.3433474.
Adu Sarfo, P., Zhang, J., Nyantakyi, G., Lassey, F. A., Bruce, E., & Amankwah, O. (2024). Influence of green human resource management on firm's environmental performance: Green employee empowerment as a mediating factor. *PLoS One*, *19*(4), e0293957. https://doi.org/10.1371/journal.pone.0293957.
Agnese, P., Battaglia, F., Busato, F., & Taddeo, S. (2023). ESG controversies and governance: Evidence from the banking industry. *Finance Res. Lett.*, *53*, 103397. https://doi.org/10.1016/j.frl.2022.103397.
Al Koliby, I. S., Mehat, N. A. B., Al-Swidi, A. K., & Al-Hakimi, M. A. (2024). Is knowledge management a missing link? Linking entrepreneurial competencies and sustainable performance of manufacturing SMEs. *The Bottom Line*, *37*(1), 71-97. https://doi.org/10.1108/BL-07-2023-0230.
Alsafadi, Y. & Altahat, S. (2021). Human resource management practices and employee performance: The role of job satisfaction. *J. Asian Finance Econ. Bus.*, *8*(1), 519-529. https://doi.org/10.13106/jafeb.2021.vol8.no1.519.
Asif, M., Searcy, C., & Castka, P. (2023). ESG and Industry 5.0: The role of technologies in enhancing ESG disclosure. *Technol. Forecasting Social Change*, *195*, 122806. https://doi.org/10.1016/j.techfore.2023.122806.
Baker, M. J. (2017). *Marketing Strategy and Management*. London: Bloomsbury Publishing.
Belas, J., Chovancova, B., Gavurova, B., Kljucnikov, A., Cepel, M., Kotaskova, A., & Virglerova, Z. (2018). *Business Management*. Žilina: Georg.
Boxall, P. & Purcell, J. (2016). *Strategy and Human Resource Management*. London: Palgrave Macmillan.
Christopher, M. (2016). *Logistics & Supply Chain Management*. London: Pearson.
Chung, R. K., Margolin, A. M., & Vyakina, I. V. (2023). Theory and practice of ESG transformation of management systems. *Econ. Policy*, *18*(2), 80-103. https://doi.org/10.18288/1994-5124-2023-2-80-103.
Dessler, G. (2017). *Human Resource Management*. London: Pearson.
Edmans, A. (2023). The end of ESG. *Financial Manage.*, *52*(1), 3-17. https://doi.org/10.1111/fima.12413.
Elshaer, I. A., Azazz, A. M., & Fayyad, S. (2023). Green human resources and innovative performance in small- and medium-sized tourism enterprises: A mediation model using PLS-SEM data analysis. *Mathematics*, *11*(3), 711. https://doi.org/10.3390/math11030711.
Etienne Fabian, N., Dong, J. Q., Broekhuizen, T., & Verhoef, P. C. (2024). Business value of SME digitalisation: When does it pay off more? *Eur. J. Inf. Syst.*, *33*(3), 383-402. https://doi.org/10.1080/0960085X.2023.2167671.
Fu, T. & Li, J. (2023). An empirical analysis of the impact of ESG on financial performance: The moderating role of digital transformation. *Front. Environ. Sci.*, *11*, 1256052. https://doi.org/10.3389/fenvs.2023.1256052.
Gallo, P., Kusnirova, R., Vachal, J., Strakova, J., & Rauser, D. (2023). Application of BSC and EFQM models in small and medium-sized enterprises. *J. Bus. Sectors*, *1*(1), 20-31. https://doi.org/10.62222/EQEW7654.
Grönroos, C. (2007). *Service Management and Marketing: Customer Management in Service Competition*. Hoboken: John Wiley & Sons.
Gyensare, M. A., Adomako, S., & Amankwah-Amoah, J. (2024). Green HRM practices, employee well-being, and sustainable work behavior: Examining the moderating role of resource commitment. *Bus. Strategy Environ.*, *33*(4), 3129-3141. https://doi.org/10.1002/bse.3642.
Heizer, J., Render, B., & Munson, C. (2020). *Operations Management: Sustainability and Supply Chain Management*. London: Pearson.
Holl, A. & Rama, R. (2024). Spatial patterns and drivers of SME digitalisation. *J. Knowl. Economy*, *15*(2), 5625-5649. https://doi.org/10.1007/s13132-023-01257-1.
Kagermann, H., Wahlster, W., & Helbig, J. (2013). Securing the future of German manufacturing industry: Recommendations for implementing the strategic initiative Industrie 4.0. *Final Rep. Ind.*, *4*, 678.
Kanno, M. (2023). Does ESG performance improve firm creditworthiness? *Finance Res. Lett.*, *55*, 103894. https://doi.org/10.1016/j.frl.2023.103894.
Katsamakas, E. & Sanchez-Cartas, J. M. (2023). A computational model of the competitive effects of ESG. *PLOS One*, *18*(7), e0284237. https://doi.org/10.1371/journal.pone.0284237.
Khamdamov, A., Tang, Z., & Hussain, M. A. (2023). Unpacking parallel mediation processes between green HRM practices and sustainable environmental performance: Evidence from Uzbekistan. *Sustainability*, *15*(2), 1434. https://doi.org/10.3390/su15021434.
Khan, K. A., Akhtar, M. A., Vishwakarma, R. K., & Hoang, H. C. (2023). A sectoral perspective on the sustainable growth of SMEs. Empirical research in the V4 countries. *J. Bus. Sectors*, *1*(1), 10-19. https://doi.org/10.62222/CVFW6962.
Kottler, P. & Keller, K. L. (2009). *Marketing Management*. Jakarta: Erlangga.
Kumar, L. & Sharma, R. K. (2024). Examining interdependencies among solution dimensions for sustainable development in SMEs based on Industry 4.0 concept. *Kybernetes*. https://doi.org/10.1108/K-09-2023-1674.
Nielsen, H. & Villadsen, K. (2023). The ESG discourse is neither timeless nor stable: How Danish companies

'tactically' embrace ESG concepts. *Sustainability*, *15*(3), 2766. https://doi.org/10.3390/su15032766.
Perez, J. A. E., Ejaz, F., & Ejaz, S. (2023). Green transformational leadership, GHRM, and proenvironmental behavior: An effectual drive to environmental performances of small-and medium-sized enterprises. *Sustainability*, *15*(5), 4537. https://doi.org/10.3390/su15054537.
Sahin, Ö., Bax, K., Paterlini, S., & Czado, C. (2023). The pitfalls of (non-definitive) Environmental, Social, and Governance scoring methodology. *Global Finance J.*, *56*, 100780. https://doi.org/10.1016/j.gfj.2022.100780.
Saks, A. M. (2022). Caring human resources management and employee engagement. *Human Resour. Manage. Rev.*, *32*(3), 100835. https://doi.org/10.1016/j.hrmr.2021.100835.
Shao, J., Ahmad, H., Butt, A. H., Shao, H., Liu, Y. D., & Alam, F. (2024). Optimizing sustainable performance green talent management strategies focused on core competencies. *J. Global Inf. Manage.*, *32*(1), 1-24. https://doi.org/10.4018/JGIM.352495.
Tan, Y. M., Szulczyk, K., & Sii, Y. H. (2023). Performance of ESG-integrated smart beta strategies in Asia-Pacific stock markets. *Res. Int. Bus. Finance*, *66*, 102008. https://doi.org/10.1016/j.ribaf.2023.102008.
Tick, A., Saáry, R., & Kárpáti-Daróczi, J. (2022). Conscious or indifferent–concerns on digitalisation and sustainability among SMEs in Industry 4.0. *Serb. J. Manage.*, *17*(1), 145-160. https://doi.org/10.5937/sjm17-36412.
Wang, G., Gunasekaran, A., Ngai, E. W., & Papadopoulos, T. (2016). Big data analytics in logistics and supply chain management: Certain investigations for research and applications. *Int. J. Prod. Econ.*, *176*, 98-110. https://doi.org/10.1016/j.ijpe.2016.03.014.
Wang, S. & Esperança, J. P. (2023). Can digital transformation improve market and ESG performance? Evidence from Chinese SMEs. *J. Cleaner Prod.*, *419*, 137980. https://doi.org/10.1016/j.jclepro.2023.137980.
Wang, Z. H. & Makhbul, Z. K. M. (2024). Green human resource management as a catalyst for sustainable performance: Unveiling the role of green innovations. *Sustainability*, *16*(4), 1453. https://doi.org/10.3390/su16041453.
Wirtz, J. & Lovelock, C. (2021). *Services Marketing: People, Technology, Strategy*. New Jersey: World Scientific Publishing.
Yusliza, M. Y., Tanveer, M. I., Ramayah, T., Kumar, S. C., Saputra, J., & Noor Faezah, J. (2021). Perceived green human resource management among employees in manufacturing firms. *Pol. J. Manage. Stud.*, *23*(1), 470-486. http://doi.org/10.17512/pjms.2021.23.1.29.
Zeithaml, V. A., Bitner, M. J., & Gremler, D. D. (2018). *Services Marketing: Integrating Customer Focus Across the Firm*. New Jersey: McGraw-Hill Education.
Zhu, J. & Huang, F. (2023). Transformational leadership, organizational innovation, and ESG performance: Evidence from SMEs in China. *Sustainability*, *15*(7), 5756. https://doi.org/10.3390/su15075756.