

ENHANCING THE VIETNAMESE SMEs' ADAPTATION TO CLIMATE CHANGE THROUGH HUMAN RESOURCES: THE MEDIATING EFFECT OF ADAPTABILITY CULTURE

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Abstract

Adaptation to climate change has emerged as a significant priority for policy and research efforts. This study delves into the multifaceted issue of climate change adaptation within Small and Medium-sized enterprises (SMEs) operating in Vietnam. Beyond merely mitigating vulnerability, these enterprises are actively seeking out avenues for green innovation, using adaptive diversification strategies to navigate the challenges posed by a changing climate. Adaptation to climate change has emerged as a significant priority for policy and research efforts. This study focuses on the adaptation strategies of SMEs in Vietnam in response to climate change. It not only aims to mitigate vulnerability but also explores green innovation opportunities through adaptive diversification. The research investigates the influence of human resources on the ability to adapt to diversification, with organizational adaptive culture acting as a mediating variable within the theoretical framework of the Resource-Based View (RBV). Through an analysis of survey data from 280 SMEs in Vietnam using Structural Equation Modeling (SEM) in SmartPLS4, the study reveals that both human resources and adaptive culture positively impact SMEs' adaptation to climate change. These findings provide valuable insights for management and policy, underscoring the importance of investing in human resources and nurturing adaptability culture within SMEs to effectively tackle climate change challenges.

Keywords

Adaptability culture (CUL), climate change adaptation (CCA), diversification adaptation, human resources (HR), Resource-based view (RBV)

JEL Classification

M12, M14

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Introduction

Over recent years, the world has witnessed significant shifts in climate patterns, manifesting in extreme weather events such as record temperatures, floods, cyclones, droughts, and forest fires. Research suggests that climate change plays a significant role in exacerbating these occurrences [twenty four]. Particularly vulnerable to these impacts are developing countries due to the inherent vulnerabilities in their socioeconomic systems. For instance, Vietnam ranked 91st out of 191 countries in terms of natural disaster risk in 2019 [twenty eight].

Recognizing the urgency of addressing climate change, governments worldwide are increasingly embracing green growth and implementing robust climate change adaptation policies. However, this effort doesn't rest solely on governments' shoulders. Small and medium-sized enterprises (SMEs), which form the backbone of many economies and provide significant employment opportunities, also face substantial costs and an imperative to adapt for sustainable development [twenty five]. SMEs have emerged as crucial partners in diversifying climate change adaptation strategies, contributing innovative technologies, adaptable business models, and fresh approaches across various sectors. Despite their flexibility, SMEs encounter barriers hindering effective adaptation efforts, including limited resources, organizational indifference to climate change, and insufficient motivation to invest in adaptation responses [eight].

The capability of a company to adapt to environmental changes and innovate strategies hinges significantly on its human resources. According to the RBV theory, investment in specific organizational resources, such as proficient management skills and employees' environmental awareness, can spur environmental action and confer competitive advantages [three]. Assigning responsibility for climate change mitigation to senior managers and implementing results-based remuneration schemes incentivizes appropriate response strategies like emissions reduction and innovation [nine]. Additionally, a company's adaptability to environmental changes relies on the flexibility of its human resources, encompassing employees' skills, behaviors, and adaptability in practices [ten]. Organizational culture, intertwined with HR systems, plays a pivotal role in resilience and performance, mediating the effects of HR on organizational change and performance [twenty two]. An adaptive culture, characterized by viewing crises as opportunities, fosters organizational resilience [fourteen]. In the context of climate change, corporate governance aligns with the RBV framework, emphasizing specific organizational resources for environmental action and competitive advantage [two].

This study, hence, employs the RBV framework to assess the impact of human resources, through adaptive culture, on SMEs' climate change adaptation activities. It explores the varied responses of SMEs to climate change threats, underscoring the importance of leveraging organizational resources and fostering an adaptive culture for effective adaptation.

Literature review and hypothesis development

Climate change adaptation

Corporate responses to climate change can be categorized into biophysical and politico-economic approaches [nineteen]. Biophysical focuses on emission reduction and environmental impact minimization, while politico-economic manages socio-economic risks [nine]. Adaptation and mitigation are increasingly viewed as interconnected processes with mitigation itself considered a form of adaptation (Jones et al., 2021).

Enterprise adaptability involves adjusting strategy, operations, and governance in response to external changes while business adaptability responds to anticipated shifts [twenty nine]. Adaptability is crucial for navigating global transformations. Debates exist regarding firms' adaptability in seizing digital-era opportunities like diversification. Diverse economies are less vulnerable to shocks, aiding growth, and adaptation studies categorize into incremental and transformative types. Incremental

adaptation involves proactive responses to climate hazards with product diversification as a core strategy [twenty seven].

Theoretical framework

The resource-based view (RBV) provides insight into why organizations thrive or falter in the marketplace by concentrating on firm-specific capabilities. For resources to confer a competitive advantage, they must meet specific criteria: value, rarity, inimitability, and non-substitutability [three]. Barney (1991) classifies resources into three main types: physical capital (comprising physical assets, technology, and plant and equipment), human capital (encompassing skills, experience, and knowledge), and organizational capital (including formal structures). However, Brumagim (1994) contends that all firms possess a diverse array of resources and capabilities. Thus, distinguishing between various tangible resources such as managerial talent and intangible ones like organizational culture is crucial, as both contribute to overall capabilities.

In this study, we leverage the RBV theory as the foundation for constructing hypotheses. Specifically, we focus on two resources derived from RBV: human resources (considered tangible resources) and adaptive culture (recognized as intangible resources). Our aim is to assess the influence of these two resources on the climate change adaptation initiatives and outcomes of SMEs.

Hypothesis Development

Endorsing specific corporate values and implementing new human resources practices can help organizations develop a wider range of employee skills and behavioral repertoires. Human resource policies and practices, in particular, are often designed to encourage employee behaviors that align with the company's strategic direction and corporate values. The close relationship between HR systems and organizational culture is well-documented [twenty two]. For example, Lau and Ngo (2004) found that HR practices emphasizing extensive training, performance-based rewards, and team development foster an innovative organizational culture. Ngo and Loi (2008) argued that, among different organizational cultures, adaptability culture is most relevant to HR flexibility due to their shared focus on responsiveness and adaptation to the external environment. This suggests a potential link between HR flexibility and adaptability culture, as both emphasize responsiveness to a dynamic environment [ten]. Bhattacharya et al. (2005) further support this link by defining HR flexibility as the skills and behaviors employees need to adapt to such an environment. Hence, the following research hypotheses are derived:

Hypothesis 1: Human resources (HR) have a positive adaptability culture (CUL).

Adaptability culture can be defined as a company's ability to adjust to its environment in order to thrive in the marketplace [twenty two]. Successful ideas and values become ingrained in the organization through the implementation of management practices. Organizational culture plays a vital role for organizational resilience and performance, enabling employees to effectively respond to environmental changes [twenty seven]. The concept of an adaptive culture, where leaders and employees view crises as opportunities, is a significant factor in determining organizational resilience [fifteen]. Organizational resilience is rooted in the expertise, capabilities, and knowledge of its people, along with established routines and procedures that guide the organization forward. It thrives on diversity and integration, allowing it to overcome and even benefit from disruptive surprises [fourteen]. Organizations with a clear vision, enthusiastic and committed employees, and a culture that fosters autonomy are better equipped to handle sudden challenges like climate change [twenty three]. Hence, the following research hypotheses are derived:

Hypothesis 2: Adaptability culture (CUL) has a positive impact on climate change adaptation (CCA).

From a theoretical perspective, corporate governance in the context of climate change is intricately linked to the firm's natural RBV [two]. The RBV posits that investing in specific organizational resources can spark environmental action and ultimately lead to competitive advantages [three]. Among these resources, strong managerial skills and employee environmental awareness stand out as

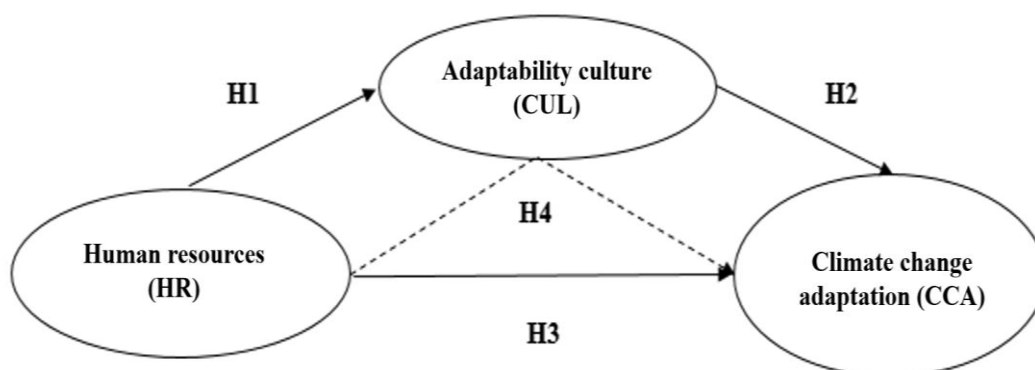
key drivers for corporate action on climate change [one]. Furthermore, assigning climate change mitigation responsibilities to senior managers and implementing outcome-based remuneration schemes incentivize appropriate response strategies such as emission reduction activities, stakeholder initiatives, and political influence [nine]. A firm's ability to adapt and respond to environmental changes hinges on its HR flexibility, which encompasses employee skill, behavior, and practice flexibility [eighteen]. Hence, the following research hypotheses are derived:

Hypothesis 3: Human resources (HR) have a positive impact on climate change adaptation (CCA).

Way et al. (2015) argue that human resource flexibility is crucial for cultivating both competitiveness and innovation. By selecting and nurturing employees with these qualities, hotels can equip themselves to adapt effectively to dynamic environmental changes (Ni et al., 2020). Flexibility can lower the risk of program failure due to uncertainty about climate impacts over the long term that may rely less on mechanisms for rapid responses to unexpected events, but more on having a well-developed culture of learning and monitoring (procedural flexibility) and some level of reversibility in conservation actions (action flexibility) [twenty one]. According to Ngo and Loi (2008), adaptability culture mediates the effect of HR flexibility on human resource performance. On the other hand, adaptability culture also mediates HR flexibility towards innovation and organizational performance [twenty two]. Hence, the following research hypotheses are derived:

Hypothesis 4. Adaptability culture (CUL) mediates the relation between human resources (HR) and climate change adaptation (CCA).

Figure 1. Proposed research model



Source: Suggested by authors

Methodology

Population and sample

SMEs, crucial for inclusive development, are studied for CCA in Vietnam, where they represent 96% of securities, contribute 36% to the national stock market, and employ 47% of the workforce. Our research examines how SMEs in key Vietnamese cities adapt to climate change. We selected SMEs based on both World Bank and local criteria and surveyed 300 SME managers to gather data on human resources, adaptability culture, and climate change adaptation activities at diversification level. We utilized both in-person and online invitations and employed snowball sampling to broaden participant representation [twenty].

The study considers classifying survey respondents according to the criteria of sector, age of business, type of business, number of employees, annual revenues. Out of 300 questionnaires collected, 280 valid responses processed, satisfied the minimum size for this study. Some missing

personal information because respondents refused to provide it was also processed and simulated (missing rate less than 5%). The results of business information statistics are shown in Table 1.

Table 1. Business information respondents

Business information	Characteristics	Quantity	Percent
Sector	Commercial, retail	82	29,29%
	Production and processing	36	12,86%
	Services/Tourism	45	16,07%
	Construction	34	12,14%
	Logistics	26	9,29%
	Finance	15	5,36%
	Accountant	14	5,00%
	Education	8	2,86%
	Insurance	15	5,36%
	Others	5	1,79%
Age of Business	Below 1 year old	2	0,71%
	1 year old – 3 years old	103	36,79%
	5 years old – 10 years old	120	42,86%
	Above 10 years old	55	19,64%
Type of Business	Private Company	3	1,07%
	Limited Liability Company	125	44,64%
	Joint-Stock Company	151	53,93%
	Partnership Company	1	0,36%
Number of employees	Below 10 employees	20	7,14%
	Below 50 employees	59	21,07%
	Below 200 employees	201	71,79%
Annual revenue	Below 3 billions VND	32	11,43%
	Below 100 billions VND	120	42,86%
	Below 200 billions VND	110	39,29%
	Below 300 billions VND	18	6,43%

Source: Data processing result by authors

Measurement

In this study, we utilized measurements from prior relevant research, assessed on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Human resources (HR) was measured through a 9-variable scale focusing on Flexibility in employee skills, behavior, and human resource practices, developed by Bhattacharya et al. (2005) and Ngo and Loi (2008). Sample items in the study included statements such as "Our employees respond to changing situations within a short time" and "Our employees can put new skills to use within a short time". The Cronbach's alpha values for these items were calculated to be 0.908, indicating high internal consistency reliability.

Adaptability culture (CUL) was assessed using a five-item scale, drawing on previous studies by Lau and Ngo (2004). Sample items included statements like "The culture of this firm could be characterized as flexible" and "Our firm emphasizes creativity and innovation." The Cronbach's alpha values for these items were calculated to be 0.822, indicating high internal consistency reliability.

Climate Change Adaptation (CCA) was assessed by integrating findings from Crawford and Seidel (2013) and expert interviews. Sample items in the study included statements like "Our company builds new standards for existing products towards sustainable development" and "Our company increases flexibility when building processes to ensure businesses' ability to adapt to climate change." The Cronbach's alpha values for these items were calculated to be 0.904, indicating high internal consistency reliability.

Control variables: The author included control variables in the regression model to address potential biases. These variables cover ownership types, industry classification, company age, size, capital, owner's education level, and manager gender, following Decree No. 39/2018/ND-CP guidelines. Gender is considered due to its potential impact on managers' perception of climate change risks [sixteen], enhancing the model's comprehensiveness.

Data analysis

The authors employed PLS-SEM, a widely recognized statistical for the analysis of their data. PLS-SEM was chosen due to its ability to handle complex models while ensuring reliability and validity criteria were met. Specifically, criteria such as Composite Reliability (CR) > 0.7 and Average Variance Extracted (AVE) > 0.5 were used to assess reliability and validity, and the Heterotrait-Monotrait (HTMT) ratio (< 0.85) was employed to evaluate discriminant validity.

In the second stage of analysis, structural model assessment and hypothesis testing were conducted using PLS-SEM. This approach allowed for the simultaneous examination of multiple relationships within the model. To determine the significance of these relationships, the authors utilized the bootstrapping technique with 5000 resamples. This technique provides robust estimates of various model parameters, including R² (explained variance), f² (effect sizes), path coefficients, t-values, and p-values. The authors selected PLS-SEM to check new relationships and assess the out-of-sample predictability of their model. This methodological choice was deemed suitable for our research objectives and ensured the highest possible reliability for the reported results throughout the research article.

Results

Results of assessing the reliability and validity of scales

To ensure the reliability and validity of variable groups, both composite reliability (CR) and average variance extracted (AVE) must surpass specific thresholds. CR should exceed 0.7 to ensure consistency, while AVE should surpass 0.5 to establish convergent validity. Convergent validity is compromised when observed variables within a factor lack correlation, suggesting inadequate explanation of the latent variable by its observed variables. Table 2 bolsters the model's consistent reliability with CR values uniformly above 0.7, aligning with Hair et al. (2019). The model's convergent validity is also satisfactory, signifying convergence of all indicators with robust correlations, effectively illuminating the latent variable. The average extracted variance coefficients AVE are all higher than 0.5 [twelve].

Table 2. Results of assessing the reliability and validity of scales

	Cronbach's Alpha	CR	AVE	Inner VIF	Fornell-Larcker criterion		
					1	2	3
1. HR	0.908	0.925	0.579	1.608	0.821		
2. CUL	0.822	0.875	0.584	1.608	0.468	0.764	
3. CCA	0.904	0.926	0.675	1.000	0.552	0.615	0.761

Source: Data processing result by authors

Results of analyzing the discriminant validity (HTMT)

Data discrimination, a crucial subsequent step in model validation, assesses the extent to which factors within the model maintain distinctness and lack correlation. Various methods, including cross-loading coefficients and the Fornell-Larcker coefficient, can evaluate discriminant validity. The criterion states that the square root of the AVE should be higher than the correlations between the constructs [eleven]. The results in Table 2 showed that this requirement was satisfied, which demonstrates the discriminant validity of the variables. Moreover, this study employs the Heterotrait-Monotrait (HTMT) coefficient. Excessively high HTMT values signal a potential issue: latent variables becoming better explained by indicators belonging to other latent variables rather than their own. In simpler terms, an overly high HTMT suggests that one latent variable's indicator is unduly explaining another latent variable. To uphold discriminant validity, HTMT values must remain below 0.85. Table 3 demonstrates HTMT values that successfully achieve this threshold, adhering to the structural model's criterion.

Table 3. Results of analyzing the discriminant validity

Factor	CCA	CUL	HR
CCA			
CUL	0.534		
HR	0.597	0.693	

Source: Data processing result by authors

Results of multicollinearity testing between latent variables

Multicollinearity arises when latent variables exhibit high correlations, leading to potential bias in R^2 and regression coefficients. To assess this, the variance inflation factor (VIF) is used. According to Hair Jr. et al. (2019), if the variance inflation factor $VIF > 2$, there are signs of multicollinearity, if $VIF > 10$, there is definitely multicollinearity, and if $VIF < 2$, the model does not suffer from multicollinearity. The results from Table 4 show that the model does not encounter multicollinearity because the variance inflation factor of all latent variables is less than 2, the largest is only 1.608.

Table 4. Variance Inflation Factors

Factor	CCA	CUL	HR
CCA			
CUL	1.608		
HR	1.608	1.000	

Source: Data processing result by authors

Results of relationship testing between latent variables

In the PLS-SEM model, the first criterion for assessing the goodness of the structural model is the explanatory power (R^2). In this study, the R^2 of CCA was 0.378, indicating moderate explanatory power. Effect sizes (f^2) were also considered: HR to CUL had a relatively high effect size of $0.608 > 0.35$, while CUL to CCA had a small effect size of $0.040 > 0.02$, and HR to CCA had an average effect size of $0.168 > 0.15$. Additionally, the Q^2 value, which measures predictive power, showed that all exogenous variables had predictive relevance (Q^2 of HR to CUL is $0.366 > 0.35$), indicating high predictive ability, and Q^2 of HR to CCA is $0.291 > 0.15$, indicating moderate predictive ability). Furthermore, the Bootstrap algorithm confirmed the statistical significance of relationships between latent variables, with all t -values exceeding 1.96. Thus, all hypotheses in the model were accepted.

Table 5. Bootstrap algorithm's results

Hypo-thesis	Path	Coeff	STDV	<i>t</i> -value	<i>p</i> -values	R^2	f^2	Q^2	Decision
H1	HR → CUL	0.615	0.053	11.530	0.000	0.331	0.608	0.366	Supported
H2	CUL → CCA	0.207	0.074	2.791	0.005		0.040		Supported
H3	HR → CCA	0.552	0.054	10.236	0.000	0.378	0.168	0.291	Supported
H4	HR → CUL → CCA	0.127	0.043	2.935	0.003				Supported

Source: Data processing result by authors

Specifically, table 5 displays the structural model results. HR positively influences CUL ($\beta = 0.615$, $t = 11.530$, $p = 0.000$), supporting hypothesis 1. CUL positively affects CCA ($\beta = 0.207$, $t = 2.791$, $p = 0.005$), supporting hypothesis 2. HR also positively impacts CCA ($\beta = 0.552$, $t = 10.236$, $p = 0.000$), supporting hypothesis 3. As seen at table 5, table 5 confirms that the relationship between HR and CCA, mediated by CUL, was positively significant at $\beta = 0.127$ ($t = 2.935$, $p = 0.003$), supporting hypothesis 4.

Discussion and implications

Theoretical implications

The study's findings have significant implications for SMEs adapting to climate change from the RBV. It suggests that SMEs can effectively adapt through HR development and cultivating an adaptive culture, even with limited resources. This approach emphasizes organizational agility, innovation, and continuous learning as key drivers of successful adaptation. By prioritizing HR and fostering an adaptive culture, SMEs can establish a solid foundation for climate change adaptation, enabling them to anticipate and respond effectively to environmental challenges. This result reflects the fact that the ability to adapt to climate change is strongly influenced by a business's HR. It is HR good at adapting that are the driving force to improve the ability to adapt to climate change, consistent with the research results of Damert and Baumgartner (2018). Adaptability culture, alongside HR, positively influences climate change adaptation (CCA) with a regression coefficient (β) of 0.207 ($t = 2.791$, $p < 0.05$). This supports previous research emphasizing adaptability as crucial for organizational innovation and response to external factors [five]. Moreover, adaptability culture acts as a mediator between HR and CCA, highlighting its importance ($\beta = 0.127$, $t = 2.935$, $p < 0.005$). An adaptable culture prioritizes responsiveness and flexibility, crucial for handling risks like climate change [twenty three].

The study makes valuable contributions to the literature on climate change adaptation in SMEs by underscoring the importance of integrating human resources and an adaptive culture for the theoretical system of climate change adaptation of businesses from an organizational resource-based perspective. By prioritizing the development of both adaptable employees and a culture that embraces change, organizations can navigate uncertainties, capitalize on opportunities, and grow sustainably in the face of environmental challenges. This approach emphasizes proactive resilience-building rather

than reactive measures, ensuring that businesses are equipped to thrive amidst evolving environmental conditions.

Managerial implications

This study underscores how SMEs can effectively adapt to climate change by prioritizing human resource development and fostering an adaptability culture. Despite limited resources compared to larger companies, SMEs can thrive by embracing organizational agility, innovation, and continuous learning. Investing in workforce skills and knowledge equips SMEs to respond adeptly to environmental challenges. Simultaneously, cultivating an adaptive culture encourages innovation and proactive responses to environmental changes. By integrating these elements, SMEs can establish a strong foundation for climate change adaptation, enabling them to anticipate and respond effectively to disruptions while identifying opportunities for sustainable growth. This proactive approach empowers SMEs to drive meaningful change beyond reactive measures, positioning them for long-term success in a changing climate. To adapt to climate change, SMEs should educate employees on sustainable practices, align recruitment with climate goals, and implement talent management for adaptation efforts. Collaborating with industry, government, and civil society enables sharing of best practices and resources, enhancing SMEs' adaptation capabilities. Next, SMEs must enhance the quality of their human resources, adapt governance structures, and foster expertise in climate change adaptation to strengthen their corporate culture and resilience. They should innovate business models, diversify to minimize climate risks, and prioritize adaptation to bolster competitiveness and meet customer needs.

In addition, the government support is crucial, with initiatives to educate SME leaders on climate change and boost workforce skills. Including SMEs in climate action organizations and facilitating knowledge exchange through forums can aid adaptation efforts. The government can offer online training modules and on-site guidance tailored to SME needs, such as providing agricultural experts to assist farmers in adapting to climate challenges. Furthermore, the Vietnamese government should actively support SMEs in climate change adaptation, providing technical assistance and educational materials. Collaboration between the government and the investment community is vital for developing resources on adaptation benefits. Academic research should be translated into accessible language, and the Ministry of Education should integrate climate adaptation topics into the education system. This ensures individuals are equipped with the necessary skills from preschool to university levels, fostering awareness and action on climate change. Specifically, the government and policymakers should have incentives and support SMEs to improve human resources, adaptability culture as well as climate change adaptation, such as financial support packages for SMEs. This may include grants, subsidies, and low-interest loans for investments in renewable energy technologies, energy-efficient equipment, and climate-resilient infrastructure. Moreover, the government can create tax incentives or rebates for SMEs that demonstrate exemplary performance in climate change adaptation, thereby incentivizing proactive action and fostering a culture of sustainability within the business community.

In summary, SMEs play a critical role in diversifying adaptation to climate change by bringing innovation, agility, local knowledge, and collaboration to the table. Governments should actively engage with SMEs and create an enabling environment that supports their contributions to climate change adaptation efforts.

Conclusion

The study acknowledges the critical role of factors such as human resources and adaptability culture in the relationship between climate change adaptation and SMEs. SMEs should prioritize human resource and adaptability culture for climate change adaptation, integrating adaptation into corporate culture, fostering innovation, and diversifying risks for sustainable development, while policymakers should support SMEs through incentives and collaboration platforms for climate change

adaptation. However, despite its contributions, the study also has several limitations that warrant consideration for future research endeavors. Firstly, the research sample collection period is relatively short, potentially limiting the temporal relevance of the findings as variables may vary over time. Secondly, the sample size is relatively small, which may hinder the generalization of the results. Future studies could address this limitation by employing larger and more diverse samples to enhance the robustness and applicability of the findings. Finally, the research model has not fully considered the role of many other factors such as information technology, financial resources, and risk management in the relationship affecting climate change adaptation. Future research could expand the scope of the model to incorporate these additional variables, providing a more comprehensive understanding of the factors driving climate change adaptation within SMEs.

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