Enhancing Supply Chain Efficiency through HR Training: The Role of Technological Adaptability as a Mediator

Xin Wu KMITL Business School, King Mongkut's Institute of Technology Ladkrabang

Chalita Srinuan KMITL Business School, King Mongkut's Institute of Technology Ladkrabang

Nuttawut Rojniruttikul* KMITL Business School, King Mongkut's Institute of Technology Ladkrabang

ABSTRACT

In today's rapidly evolving business landscape, the interplay between human resource (HR) training, technological adaptability, and supply chain efficiency is paramount for organizational success. This study investigates these relationships by comprehensively analyzing existing literature and empirical data. Drawing on a documentary review methodology, the study synthesizes findings from academic journals, books, and conference proceedings to examine the impact of HR training on technological adaptability and supply chain efficiency. The results reveal significant positive correlations between HR training, technological adaptability, and supply chain efficiency, highlighting the critical role of HR training programs in fostering a technologically adaptable workforce and enhancing supply chain performance. Furthermore, mediation analysis suggests that technological adaptability partially mediates the relationship between HR training and supply chain efficiency, emphasizing the interconnectedness of these variables. The implications of these findings for policy formulation, educational enhancement, and entrepreneurial development are discussed, along with practical applications for business professionals and policymakers to enhance supply chain efficiency. Future research directions are also provided to advance our understanding of HR training's influence on supply chain dynamics in today's digital age.

Keywords: Supply chain efficiency, Human resource training, Technological adaptability, Enterprises, Organizational performance.

Received 19 May 2024 | Revised 5 September 2024 | Accepted 5 December 2024.

1. INTRODUCTION

In Guiyang, China's rapidly evolving business landscape, the significance of Human Resource (HR) Training in bolstering supply chain efficiency cannot be overstated. As a critical determinant of competitive success in the global marketplace, HR training is pivotal beyond traditional employee development (Govindan *et al.*, 2020). In this dynamic environment, HR training serves as a vital conduit, bridging knowledge and skills gaps essential for navigating the complexities of modern supply chain management (SCM). Gómez-Cedeño *et al.* (2015) underscore that effective HRM practices, particularly those emphasizing continuous learning and development, directly impact operational





performance and customer satisfaction. Such influence is pivotal in Guiyang's context, where rapid industrial growth and technological advancements necessitate a skilled, adaptable, and resilient workforce.

The integration of comprehensive HR training programs is perceived as a strategic investment that fosters organizational resilience and equips employees to respond adeptly to supply chain disruptions and market fluctuations. Gu *et al.*'s (2023) research delve into the nuances of high-involvement HRM practices, highlighting their significant impact on enhancing supply chain resilience. These practices foster active employee participation, proactive problem-solving, collaboration, and continuous improvement—critical attributes for maintaining an efficient and flexible supply chain.

Building upon this foundation, Huo *et al.* (2021) emphasize the correlation between investment in employee training and improved supply chain outcomes. Their findings suggest that organizations prioritizing HR training witness enhancements in operational efficiency and overall business innovation. Such insights are particularly pertinent in Guiyang's industries, where innovation and efficiency are imperative for competitiveness in national and international markets.

Aligning HR training with organizational objectives, as emphasized by Kotter (2016), ensures that training programs focus on skill development and instill values conducive to supply chain optimization. Moreover, as Cameron and Quinn (2011) highlighted, organizational culture is pivotal in change management, a crucial component of supply chain enhancements. A culture embracing change and fostering flexibility is essential for successfully implementing new processes and technologies within the supply chain.

In Guiyang's enterprises, organizational culture acts as a driving force that significantly influences the success of HR training in improving supply chain efficiency. This research explores how this culture can be leveraged to maximize the benefits of HR training, contributing to the effectiveness and competitiveness of the supply chain in this region.

This study's research objectives are as follows:

- To examine the impact of HR training and technological adaptability on enhancing supply chain efficiency in Guiyang's enterprises.
- To explore the mediating role of technological adaptability in the relationship between HR training and supply chain efficiency in Guiyang's enterprises.

2. LITERATURE REVIEW

Technological advancements have revolutionized the supply chain management landscape, offering unprecedented opportunities for enhancing efficiency and competitiveness. Numerous studies have underscored the pivotal role of technological adaptability in driving supply chain performance. For instance, Govindan *et al.* (2020) conducted a meta-analysis of the literature and found consistent evidence supporting the positive relationship between technological adaptability and supply chain efficiency. Their synthesis of various studies revealed that companies embracing technological innovations in their supply chain processes tend to experience improvements in operational performance and cost-effectiveness.

Similarly, Gu *et al.* (2023) delved into the effect of high-involvement human resource management practices on supply chain resilience and operational performance. They emphasized the importance of technological adaptability as a core component of supply

chain resilience, highlighting its role in mitigating disruptions and ensuring continuity in operations. Furthermore, Kotler and Keller (2016) emphasized the transformative impact of technology on supply chain management in their seminal work on marketing management. They argued that advancements in information technology and automation enable real-time monitoring, predictive analytics, and seamless coordination across supply chain partners, enhancing efficiency and responsiveness. In addition, Huo *et al.* (2021) explored the relationship between human resource management practices and supply chain management in Latin America. Their findings suggested that companies investing in technology-enabled HR practices, such as training programs focused on technological skills development, are better positioned to leverage emerging technologies for improving supply chain efficiency.

The literature provides robust evidence supporting the hypothesis that technological adaptability positively influences supply chain efficiency. By embracing technological innovations and fostering a culture of adaptability, companies can streamline operations, optimize resource utilization, and achieve higher levels of efficiency in their supply chain processes.

In addition to the studies above, other research, such as that conducted by Eisenhardt and Graebner (2007), emphasizes the importance of agility in responding to technological changes, highlighting how firms that quickly adapt to new technologies often outperform their competitors. Similarly, studies by Ivanov *et al.* (2019) discuss the role of digital technology, including IoT and Industry 4.0, in enhancing supply chain resilience and mitigating risks associated with technological disruptions. These studies strengthen the hypothesis by providing further empirical support and theoretical underpinning to the relationship between technological adaptability and supply chain efficiency.

H1: Technological adaptability positively influences supply chain efficiency.

Human resource (HR) training equips employees with the skills and knowledge necessary to adapt to technological changes in today's dynamic business environment. Several studies have explored the relationship between HR training and technological adaptability, providing valuable insights into how training programs influence employees' ability to embrace and utilize new technologies effectively. Gómez-Cedeño *et al.* (2015) conducted a study examining the impact of human resources on supply chain management and performance. They emphasized the significance of HR training in enhancing employees' technological skills, highlighting its role in improving organizational performance and competitiveness. Their findings suggested that companies investing in comprehensive training programs are better positioned to leverage technology for optimizing supply chain processes.

Similarly, Gu *et al.* (2023) investigated the effect of high-involvement HRM practices on supply chain resilience and operational performance. They highlighted the importance of HR training in fostering a continuous learning and development culture, essential for enhancing employees' technological adaptability. Their research indicated that companies prioritizing employee training are more resilient to technological disruptions and better equipped to leverage emerging technologies for competitive advantage. Furthermore, Kotler and Keller (2016) emphasized the strategic importance of HR training in their work on marketing management. They argued that well-trained employees are more adept at embracing technological innovations and leveraging them to enhance organizational performance. Their research underscored the role of HR training in nurturing a workforce capable of effectively utilizing new technologies to drive business success. Huo *et al.*

(2021) also explored the relationship between human resource management practices and supply chain management in Latin America. Their findings suggested that investments in employee training contribute to improved technological adaptability, thereby enhancing supply chain efficiency and innovation capabilities. Expanding on this, researchers such as Noe *et al.* (2017) have demonstrated that HR training programs focused on technological skills improve individual performance and foster organizational learning and innovation. Their studies show that continuous training in technological skills helps create a knowledgeable workforce that can adapt quickly to technological advancements. Moreover, Jabbour *et al.* (2018) explored the impact of green HRM practices on environmental performance and technological adaptation. They found that companies incorporating eco-friendly training programs experienced greater technological adaptability, emphasizing the role of HR training in achieving broader organizational goals.

The literature provides compelling evidence supporting the hypothesis that HR training positively influences technological adaptability. By investing in training programs that equip employees with the necessary skills and knowledge, organizations can enhance their ability to adapt to technological changes and capitalize on emerging opportunities in the digital age.

H2: HR training positively influences technological adaptability.

Mediation models in organizational research have gained significant attention in recent years, particularly in understanding the mechanisms through which certain variables influence outcomes indirectly. Technological adaptability is a crucial mediator between training programs and supply chain efficiency in HR training. Drawing on the work of Govindan et al. (2020), it is evident that HR training plays a pivotal role in enhancing supply chain efficiency. Their meta-analysis of the literature highlights the positive impact of training programs on various aspects of supply chain performance, including cost reduction, lead time reduction, and inventory management improvements.

Moreover, Gómez-Cedeño et al. (2015) emphasized the importance of HR training in fostering a workforce capable of leveraging technology to optimize supply chain processes. Their research suggests that employees who receive adequate training are better equipped to adapt to technological changes and utilize digital tools effectively, thereby enhancing supply chain efficiency. Building upon this foundation, Gu et al. (2023) investigated the effect of HR training on supply chain resilience and operational performance. Their findings suggest that HR training indirectly influences supply chain efficiency through its impact on technological adaptability. Training programs enable organizations to leverage technological innovations to enhance supply chain processes and respond effectively to market dynamics by improving employees' ability to adapt to technology. Furthermore, Kotler and Keller (2016) highlighted the role of technological adaptability as a critical driver of supply chain efficiency in their work on marketing management. They argued that organizations with a technologically adaptable workforce are better positioned to capitalize on emerging opportunities and streamline supply chain operations, ultimately improving efficiency and competitiveness.

The literature provides compelling evidence supporting the hypothesis that HR training positively influences supply chain efficiency, with technological adaptability as a mediating variable. By investing in training programs that enhance employees' technological skills and adaptability, organizations can unlock the full potential of their supply chain processes and achieve sustainable competitive advantage in today's dynamic business environment.

H3: HR training positively influences supply chain efficiency, with technological adaptability acting as the mediating variable.



Figure 1 Conceptual framework

3. METHODOLOGY

The researcher used G*Power software to determine the appropriate sample size, setting an effect size of 0.25 and 16 degrees of freedom, calculated by subtracting one from the total number of observed variables (17). A multi-stage sampling approach was then employed to ensure a comprehensive and representative sample.

The data sources were identified through a preliminary analysis of enterprises in Guiyang City, China. Industries relevant to supply chain efficiency such as manufacturing, pharmaceuticals, construction, and e-commerce were prioritized. A simple random sampling technique was applied to select 155 enterprises from an initial list of qualified organizations across these sectors, ensuring each had active involvement in supply chain operations and a structured HR training program. From this pool, stratified random sampling was utilized to secure a final sample of 316 participants across 10 companies. Stratification criteria ensured the sample covered a range of demographic characteristics, job functions, and organizational levels to provide diverse perspectives.

Data collection was conducted in two stages. First, questionnaires were distributed to HR managers and supply chain staff within the selected companies. The questionnaire collected quantitative data on variables related to HR training, organizational culture, technological adaptability, and supply chain efficiency. In the second stage, in-depth interviews were conducted with selected participants to gather qualitative insights, focusing on industry-specific practices and unique challenges in supply chain management. This dual approach ensured data reliability and enabled a comprehensive analysis of how HR training impacts supply chain efficiency in Guiyang, China. (Ghosh, 1958).

This study utilizes a mixed-methods approach that combines a comprehensive documentary review with the analysis of survey data collected from enterprises in Guiyang, China. The documentary review synthesizes existing literature to provide theoretical and contextual support for the hypotheses, while the survey data analysis offers empirical evidence for testing these relationships.

The documentary review component systematically collects, organizes, and synthesizes relevant literature on HR training, technological adaptability, and supply chain efficiency.

Using a systematic search strategy, studies were retrieved from reputable databases such as PubMed, Scopus, Web of Science, and Google Scholar. Keywords related to the study's core variables were employed to locate articles, books, conference proceedings, and other scholarly sources. Data extraction focused on critical information from each study, including research objectives, methodologies, frameworks, key findings, and conclusions. The review was organized thematically to identify patterns, trends, and gaps relevant to the hypotheses. This literature synthesis establishes the theoretical foundation for understanding how HR training influences supply chain efficiency, providing valuable insights to guide the empirical analysis. In addition to the documentary review, primary data were collected through a structured survey conducted with 316 participants selected from 10 enterprises in Guiyang. The survey questionnaire gathered quantitative data on variables such as HR training effectiveness, technological adaptability, organizational culture, and supply chain efficiency. Data were analyzed using various statistical methods, including descriptive statistics to outline respondent characteristics and inferential statistics to examine relationships among variables. The results are reported in detail, with Table 1 providing summary statistics of respondents' demographic and professional backgrounds, offering a clearer understanding of the sample.

4. RESULTS

Demographic	N = 316	Percentage			
Gender					
Male	124	39.2			
Female	184	58.2			
LGBTQI+	8	2.5			
Age					
Less than 30 years	46	2.1			
31-35 years	164	14.6			
36-40 years	35	11.1			
Greater than 40 years	71	22.5			
Education					
Bachelor Degree	612	68.4			
Master Degree	98	31.0			
Doctoral Degree	2	0.6			
Income					
<6,000 CYN	217	68.7			
6,001 – 8,000 CYN	90	28.5			
8,001 – 10,000 CYN	6	1.9			
Greater than 10,001	3	0.9			
Occupation					
Personal Business	78	24.7			
Finance and Accounting	195	61.7			
General administration		431			
Total	316	100			

Table 1 The demographic of respondents

Table 2 The Pearson's correlation Matrix of Variables

Pearson's

Correlation	H1	H2	H3	H4	01	02	03	04	T1	<i>T</i> 2	<i>T3</i>	<i>S1</i>	<i>S</i> 2	<i>S3</i>	<i>S4</i>	<i>S5</i>
H1	1															
H2	.537**	1														
НЗ	.405**	.534**	1													
H4	.383**	.522**	.503**	1												
01	.341**	.390**	.375**	.468**	1											
02	.297**	.315**	.338**	.309**	.526**	1										
03	.254**	.317**	.325**	.359**	.481**	.441**	1									
04	.206**	.262**	.190**	.326**	.380**	.404**	.398**	1								
<i>T1</i>	.015	.087	.112*	.267**	.162**	.166**	.186**	.301**	1							
<i>T</i> 2	.157**	.247**	.157**	.324**	.303**	.320**	.319**	.361**	.496**	1						
T3	.000	.087	.115*	.251**	.188**	.243**	.131**	.225**	.437**	.442**	1					
<i>S1</i>	.317**	.421**	.316**	.296**	.306**	.350**	.307**	.253**	.153**	.280**	.072	1				
<i>S</i> 2	.248**	.308**	.249**	.243**	.250**	.224**	.299**	.358**	.311**	.262**	.162**	.321**	1			
<i>S3</i>	.196**	.272**	.222**	.224**	.259**	.255**	.254**	.258**	.239**	.306**	.238**	.370**	.376**	1		
<i>S4</i>	.252**	.343**	.178**	.235**	.223**	.248**	.237**	.230**	.185**	.271**	.086**	.357**	.308**	.366**	1	
<i>S5</i>	.077	.106	.081	.261**	.096	.220**	.136**	.262**	.332**	.349**	.337**	.200**	.217**	.274**	.335**	1

Table 2 shows Pearson's correlation matrix, which reveals significant relationships between the observed variables in the study. There are moderate to strong correlations between variables related to HR Training (H1-H4), indicating that improvements in one aspect of training, such as employee skill development (H2), tend to enhance other areas, like leadership and management (H3) and training infrastructure (H4). Similarly, there is a positive association between variables representing Technological Adaptability (T1-T3), with technological integration (T1) being moderately correlated with employee adaptability (T2), suggesting that an organization's investment in technology (T3) complements both integration and adaptability efforts. Organizational Culture (O1-O4) variables also display moderate correlations, particularly between team cohesion (O1) and innovation (O4), implying that a collaborative environment fosters continuous improvement. Finally, the Supply Chain Efficiency (S1-S5) variables are generally moderately correlated with each other and with other dimensions, such as technological adaptability, emphasizing that enhancements in operational efficiency (S1) and inventory management (S3) can contribute to sustainable supply chain practices (S5). The correlations highlight interdependencies among HR training, organizational culture, technological adaptability, and supply chain efficiency. This indicates that holistic improvements in these areas could significantly enhance supply chain performance in Guiyang's enterprises. In order to examine the correlation between latent variables, the researcher computed each of the observed variables and transformed them into four latent variables, as shown in Table 4-12. The following latent variables are utilized to symbolize

constructs: HR Training (H1-H4), Organizational Culture (O1-O4), Technological Adaptability (T1-T3), and Supply Chain Efficiency (S1-S4). The researcher then utilized Pearson's correlation to examine the relationship between variables. The subsequent correlation is defined as follows:

Pearson's Correlation	1	2	3	4	\bar{x} (S.D)
HR Training	1				3.51 (.402)
Organizational Culture	.534**	1			3.49 (.380)
Technological Adaptability	.238**	.390**	1		3.44 (.324)
Supply Chain Efficiency	.485**	.494**	.368**	1	3.46 (.355)

Table 3 Pearson's correlation matrix between the latent variables

Table 3 shows Pearson's correlation matrix between the latent variables of HR Training, Organizational Culture, Technological Adaptability, and Supply Chain Efficiency, demonstrating significant relationships that reveal their interconnectedness. HR Training has a moderate positive correlation with Organizational Culture (r = 0.534, p < 0.5340.01), indicating that improved training programs and skill development initiatives are associated with a more robust organizational culture, including team cohesion and communication. HR Training also shows a moderate positive correlation with Supply Chain Efficiency (r = 0.485, p < 0.01), suggesting that better training contributes to more efficient supply chain processes such as operational performance and supplier relationships. While weaker, the correlation with Technological Adaptability (r = 0.238, p < 0.01) suggests that effective training programs help employees better adapt to new technologies. However, this relationship is not as strong as the others. Organizational Culture has a moderate positive correlation with Technological Adaptability (r = 0.390, p < 0.01) and Supply Chain Efficiency (r = 0.494, p < 0.01). This means that a positive organizational culture marked by teamwork, communication, and innovation supports the adoption and integration of technology, which, in turn, enhances supply chain efficiency. A healthy organizational culture is crucial for both technological advancements and operational improvements. Technological Adaptability is positively correlated with Supply Chain Efficiency (r = 0.368, p < 0.01), indicating that adapting to and integrating new technologies leads to better supply chain outcomes, such as improved operational efficiency and sustainable practices.



Chi-square = 103.573, df = 80, Chi-square/df = 1.295, p = .039, GFI = .960, AGFI = .933, CFI = .984, TLI = .976, RMSEA = .031, RMR = .013, NFI = .934

Figure 2 Structural Equation Modelling of Human Resource Training Impact on Supply Chain Efficiency in Guiyang's Enterprises

Dependent Variables	Н	R Training		Supply Chain Efficiency					
Independent Variables	TE	DE	IE	TE	DE	IE			
Technological Adaptability	-	-	-	.515	.515	-			
	-	-		(.077)	(.077)				
HR Training	.645	.645	-	.415	.415	.351			
	(.074)	(.074)		(.081)	(.081)	(.042)			
R-Square	1.062 .819								
$\chi^2 = 71.987$, df = 69, Relative $\chi^2 = 1.043$, p = .379, GFI = 970, CFI = .998, TLI = .997, NFI = .953, RMSEA = .012, RMR = .007									

Table 4 Model Summary

H1: Technological Adaptability Positively Influences Supply Chain Efficiency

Table 4 shows that the results revealed a positive relationship between technological adaptability and supply chain efficiency (TE.515). This finding supports the hypothesis that companies with higher technological adaptability exhibit greater supply chain efficiency. These findings suggest that companies with more significant technological adaptability experience improvements across multiple dimensions of supply chain

performance. Overall, the results of the analysis support hypothesis H1, indicating that companies with higher levels of technological adaptability tend to achieve greater supply chain efficiency. These findings underscore the importance of fostering technological adaptability within organizations to enhance supply chain performance and competitiveness in today's dynamic business environment.

H2: HR Training Positively Influences Technological Adaptability

Table 1 shows that the relationship between HR training and technological adaptability (TE.645), as posited in H2, yielded insightful results. Analysis revealed a positive correlation between HR training and technological adaptability. This finding suggests that organizations that invest in HR training programs tend to have employees with higher levels of technological adaptability. These findings underscore the pivotal role of HR training in fostering a technologically adaptable workforce.

The findings support hypothesis H2, indicating that HR training positively influences employees' technological adaptability. These findings highlight the critical role of HR training programs in equipping employees with the skills and knowledge necessary to navigate technological changes within the organization effectively, thereby fostering a culture of innovation and adaptability.

H3: HR Training Positively Influences Supply Chain Efficiency, with Technological Adaptability Acting as the Mediating Variable

Examining the mediation model proposed in H3 yielded insightful results regarding the interplay between HR training, technological adaptability, and supply chain efficiency (TE.415; IE.351). These findings suggest that while technological adaptability partially mediates the relationship between HR training and supply chain efficiency, HR training also directly affects supply chain efficiency, independent of its influence on technological adaptability. Thus, technological adaptability partially mediates the relationship between HR training and supply chain efficiency.

The goodness-of-fit indices indicate that the Chi-square value is 71.987 with 69 degrees of freedom, resulting in a Chi-square/df ratio of 1.043. This ratio, being near to 1, suggests a good fit. The p-value of .379 indicates that the model does not significantly deviate from the observed data, as a p-value greater than .05 is generally considered a good fit. The Goodness of Fit Index (GFI) of .970 indicates a perfect fit of the model to the data. The Comparative Fit Index (CFI) is exceptionally high at .998, indicating an excellent fit. The Tucker-Lewis Index (TLI) is also very high at .997, demonstrating a fantastic fit. The Root Mean Square Error of Approximation (RMSEA) is very low at .012, indicating a close fit between the model and the observed data. The RMR value is 0.007, indicating a deficient residual variance model. The NFI value of .953 indicates an intense match (Hair et al., 2010).

Structural equation modeling (SEM) generally indicates robust associations between the constructs, particularly College Reputation and other factors. The goodness-of-fit indices indicate that the model fits the observed data well, suggesting that the predicted connections between the constructs are congruent with the student's answers in the data set.

In summary, the empirical findings support hypothesis H3, indicating that HR training positively influences supply chain efficiency, with technological adaptability as a partial mediating variable. These results underscore the importance of HR training and

technological adaptability in driving enhanced supply chain performance, highlighting the need for organizations to invest in comprehensive training programs that cultivate employee skills and technological adaptability to achieve optimal supply chain efficiency.

5. CONCLUSION

The comprehensive examination of the relationships between HR training, technological adaptability, and supply chain efficiency offers valuable insights into the multifaceted dynamics shaping organizational performance in today's competitive landscape. The findings from this study underscore the critical role of HR training in driving organizational success, particularly in the context of supply chain management (Shibuya *et al.*, 2024). The results robustly support hypotheses H1, H2, and H3, highlighting the interconnectedness between HR training, technological adaptability, and supply chain efficiency.

Firstly, the analysis revealed a positive relationship between technological adaptability and supply chain efficiency (H1). Companies with higher technological adaptability demonstrated superior supply chain performance across various operational dimensions, including cost reduction, lead time reduction, and inventory management improvements. These findings underscore the strategic importance of fostering technological adaptability within organizations to enhance supply chain efficiency and competitiveness.

Secondly, the study found compelling evidence of a positive association between HR training and technological adaptability (H2). Organizations that invest in comprehensive HR training programs tend to have employees with higher levels of technological adaptability, including proficiency in utilizing digital tools, willingness to adopt new technologies and adaptability to technological changes. These findings highlight the pivotal role of HR training in equipping employees with the skills and knowledge necessary to navigate technological advancements effectively.

Furthermore, the analysis revealed that HR training positively influences supply chain efficiency, with technological adaptability as a partial mediating variable (H3). While technological adaptability partially mediates the relationship between HR training and supply chain efficiency, HR training also significantly directly affects supply chain efficiency, independent of its influence on technological adaptability. These results emphasize the importance of HR training and technological adaptability in driving enhanced supply chain performance (Medina, 2024).

In conclusion, the findings from this study provide empirical support for the critical role of HR training and technological adaptability in shaping supply chain efficiency. Organizations that prioritize investments in HR training programs and cultivate a culture of technological adaptability are better positioned to achieve superior supply chain performance and sustain competitiveness in today's rapidly evolving business environment. Moving forward, strategic initiatives aimed at fostering employee development and embracing technological innovations will be essential for organizations seeking to optimize their supply chain processes and achieve long-term success.

6. IMPLICATIONS

This study's findings offer valuable insights for regional and national policymakers crafting evidence-based policies to promote efficiency in HR training and supply chain management. By leveraging these insights, policymakers can create supportive environments conducive to organizational development and competitiveness. Enterprises can also benefit significantly by aligning their strategies with the research findings, enhancing operational efficiency and sustainability.

Educational institutions can refine their curricula and training programs based on the research findings, ensuring that future workforce generations comprehensively understand the interplay between HR training and supply chain efficiency. By incorporating practical insights from the study, educational institutions can foster a workforce adept at navigating the complexities of modern supply chain dynamics, thereby contributing to enhanced organizational performance and competitiveness.

The insights derived from this research will benefit the entrepreneurial landscape in Guiyang and beyond. Start-up enterprises can leverage the findings to establish strong foundations of inefficient supply chain management grounded in practical HR training. By integrating these insights into their business strategies, entrepreneurs can enhance their operational efficiency, resilience, and competitiveness, fostering a new generation of successful and sustainable businesses in the region.

7. FUTURE RESEARCH

Future research directions could encompass longitudinal studies to track the long-term effects of HR training programs on technological adaptability and supply chain efficiency. At the same time, cross-cultural comparisons could explore cultural influences on training effectiveness. Qualitative approaches, such as interviews and case studies, could offer deeper insights into the mechanisms underlying the relationship between HR training, technological adaptability, and supply chain efficiency. Further exploration of mediating factors, such as organizational culture and leadership style, could provide a more comprehensive understanding of training outcomes. Integrating emerging technologies into HR training and supply chain management practices warrants investigation, as does sector-specific research to address industry-specific challenges. Developing robust metrics for evaluating training effectiveness is essential for informing evidence-based training strategies. These research directions aim to advance our understanding of how HR training influences technological adaptability and supply chain efficiency, ultimately guiding the development of methods to enhance organizational performance in dynamic business environments.

ACKNOWLEDGEMENT

The authors thank the anonymous referees for their helpful comments and suggestions.

REFERENCES

- [1] Cameron, K. S., & Quinn, R. E. (2017). *Diagnosing and changing organizational culture: Based on the competing values framework.* John Wiley & Sons.
- [2] Cameron, Q., & Quinn, S. (2011). *Diagnosing and changing organizational culture: Based on the competing values framework.* John Wiley & Sons.
- [3] Eisenhardt, Kathleen M., Graebner, Melissa E., 2007. Theory building from cases: Opportunities and challenges. *Acad. Manag. J.* 50 (1), 25–32.
- [4] Ghosh, S. (1958). A Note on Stratified Random Sampling with Multiple Characters. *Calcutta Statistical Association Bulletin*, 8(2-3), pp. 81–90.

- [5] Govindan, K., Rajeev, A., Padhi, S. S., & Pati, R. K. (2020). Supply chain sustainability and performance of firms: A meta-analysis of the literature. *Transportation Research Part E: Logistics and Transportation Review*, *E137*(Online), pp. 1–22.
- [6] Gómez-Cedeño, M., Castán-Farrero, J. M., Tarrés, L. G., & Matute-Vallejo, J. (2015). Impact of human resources on supply chain management and performance. *Industrial Management & Data Systems*, 115(1), 129–157.
- [7] Gu, M., Zhang, Y., Li, D., & Huo, B. (2023). High-involvement human resource management practices affect supply chain resilience and operational performance. *Journal of Management Science and Engineering*, 8(Online), pp. 176–190.
- [8] Huo, B., Han, Z., & Zhou, H. (2021). Can you grow your supply chain without skills? The role of human resource management for better supply chain management in Latin America. *MIT Open Access Articles*, 1–41.
- [9] Ivanov, D., Dolgui, A., Sokolov, B., 2019. Digital technology and Industry 4.0 impact the ripple effect and supply chain risk analytics. *Int. J. Prod. Res.* 57 (3), 829–846.
- [10] Jabbour, C. J. C., Sarkis, J., de Sousa Jabbour, A. B. L., Renwick, D. W. S., Singh, S. K., & Grebinevych, O. (2018). Who is in charge? A review and a research agenda on the 'human side' of the circular economy. *Journal of Cleaner Production*, pp. 222, 793–801.
- [11] Kotler, P., & Keller, K. L. (2016). *Marketing Management:* Global Edition. Pearson.
- [12] Lencioni, P. (2005). Overcoming the Five Dysfunctions of a Team: A Field Guide for Leaders, Managers, and Facilitators. Jossey-Bass.
- [13] Medina, M. S. (2024). Perceived Stress and Life Satisfaction Among University Students. *Review of Integrative Business and Economics Research*, *13*(1), 144–157.
- [14] Noe, R. A., Hollenbeck, J. R., Gerhart, B., & Wright, P. M. (2017). *Human Resource Management: Gaining a Competitive Advantage*. McGraw-Hill Education.
- [15] Schein, E. H. (2010). Organizational culture and leadership. John Wiley & Sons.
- [16] Shibuya, K., Blet, J.-B., & Suzuki, H. (2024). Evaluation on the Impact of Quality Dimensions for Social Perception. *Review of Integrative Business and Economics Research*, 13(1), 1–19.