FINTECH ADOPTION AND ENVIRONMENTAL PERFORMANCE: EXPLORING THE MEDIATING ROLE OF GREEN INNOVATION & FINANCING IN COMMERCIAL BANKS

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Abstract
The increasing adoption of financial technologies (Fintech) has raised questions about their influence on environmental sustainability in the banking sector. A quantitative approach was employed using a structured questionnaire distributed to 302 employees of commercial banks in Pakistan. Partial Least Squares Structural Equation Modelling (PLS-SEM) was applied to test the proposed relationships. Findings reveal that Fintech adoption significantly enhances both green finance and green innovation. Green finance and green innovation, in turn, positively influence environmental performance, serving as mediators in this relationship. Financial literacy moderates the relationships, strengthening the effects of Fintech adoption on green finance and innovation. The model confirms that environmentally oriented financial technologies, combined with informed stakeholders, contribute to improved sustainability outcomes in banking operations.

Keywords - Fintech, Green Finance, Financial literacy, financial empowerment, microfinance, Environmental Performance

1. Introduction

Many studies explore the relationship between sustainable development and its important role in public economies and various business environments. Researchers emphasize that focusing on sustainability can help achieve cultural goals beyond financial gains. Over the past century, it has become clear that traditional approaches have often overlooked the "human" or "social" aspect, treating people as mere mechanical components. To truly pursue sustainability, we must prioritize basic human rights and dignity (Moreau et al., 2021; Abdallah et al 2025; Aslam et al 2025; Nawaz et al 2025). While financial growth has its benefits, it also has drawbacks, as it often ignores essential human values and social considerations.

Historically, a unidimensional spotlight on financial development has required the constant double-dealing of natural resources, bringing about uncommon environmental damage. This harm surpasses any past cases in human history. A defining characteristic of this phenomenon is the pervasive encroachment of green technology into natural ecosystems. (Silvestri & Veltri, 2019; Sadiq et al 2026). Green innovation is applied in financial technology to provide financial services and goods to consumers (Dwivedi et al., 2023; Aslam et al 2026; Nawaz et al 2024). Conversely, green finance is characterized as monetary interest in the scope of harmless to the ecosystem tasks and exercises that assist organizations with accomplishing natural productivity and innovation extension towards a more economical economy (Zheng et al., 2021; Shabbir and Putra 2026).

In this study, as shown in Figure 1, fintech adoption is chosen as the independent variable for this study because of its impact on environmental performance. Environmental Performance is considered a dependent variable because it enhances the protection against environmental degradation. Green finance and green innovation are considered a mediating variable. Finally,

financial literacy is considered a moderating variable. Banks have various impacts and relationships on corporate administration structures. As many organizations have taken on fintech because of powerless corporate administration (Arnaboldi & Rossignoli, 2015; Aslam et al 2026; Nawaz et al 2024; Xiaoying Wang, Sadiq, Khan, & Wang, 2021), counting Northern Stone, Lehman Siblings, Enron, and Exxon Mobil, this issue is built up is with partnered organizations, the administration of the area becomes basic. The writing proposes that financial organizations face one-of-a-kind difficulties that make corporate administration in these foundations not quite the same as other non-monetary organizations(Bhatia & Gulati, 2021). Banking corporate administration is significant for the two banks and monetary bosses. As indicated by the tried and true way of thinking, great administration can uphold bank execution, while unfortunate administration can prompt precariousness and sabotage steadiness and security (Brogi & Lagasio, 2019).

For instance, research by (Ayadi, Ayadi, and Trabelsi (2019) found that interior control and capital guidelines complete one another and all together affect bank execution. Banking risk is significant for the two banks and monetary establishments. Ordinary reasoning holds that expanded gambling is fulfilling, however, it additionally opens banks to risk (Vives, 2019; Aslam et al 2026;). A superior comprehension of bank chances is pivotal for different monetary market members (Haq & Heaney, 2012). Surveying bank risk is vital for controllers and market screens investors and bondholders, as indicated by a concentration of scientists and different specialists, bank risk unfavorably affects bank execution.

2. Literature Review

2.1. Theoretical Foundation (Reasoned Action Theory)

The Reasoned Action Theory is a psychological model that explains and predicts individuals' behaviour based on their attitudes, subjective norms, and intentions. It considers that individuals are rational decision-makers and that their intentions to perform a behaviour are the best predictors of whether they will engage in that behaviour.

2.2. Fintech Adoption and Environmental Performance

Currently, researchers are focusing their attention on financial technology (fintech) due to the growing consumer demand for environmentally friendly and user-friendly financial products and services. Al Nawayseh (2020) noted that monetary establishments have finished an extensive variety of work to assist with upgrading green innovation for monetary and monetary advantages, including fintech. Fintech utilizes green innovation to offer monetary types of assistance and items to buyers (P. Dwivedi et al., 2021). Throughout the long term, propels in data and correspondence advancements have changed monetary organizations, prompting green and shrewd execution of establishments and working on natural supportability (Yan, Siddik, Akter, & Dong, 2021; Fahamsyah et al 2025). Past exploration has distinguished green development as a solid sign of natural execution (Awawdeh et al., 2021). Further P. Dwivedi et al. (2021) saw that fintech reception significantly affects the intensity and general execution of the financial business.

H1: *Fintech Adoption positively enhances the environmental performance of banking institutions.*

2.3. Fintech Adoption, Green Finance, and Green Innovation

Existing writing showed the effect of green finance and corporate environmental performance on both green development and corporate social responsibility (Awawdeh et al., 2021). In countries with raised levels of particular or financial schooling, this could unfavorably influence green advancement. Green insurance and green establishment in like manner firmly influence green speculation and green advancement (Xiong and Sun, 2022;). In this manner, the current investigation of the connection between fintech adoption, green finance, and green advancement is dim and needs further new development. Anyway, it might be argued that undertakings in the fields of fintech, green finance, and green advancement are essential to achieving prudent execution in affiliations.

H2: *There is a positive connection between fintech adoption and green financing.*

H3: *There is a positive connection between fintech adoption and green innovation.*

2.4. Green Finance and Environmental Performance

Numerous studies have explored how green finance influences corporate environmental sustainability. The findings consistently indicate that implementing green finance initiatives leads to better environmental outcomes for organizations. For example, research by Zhang et al. (2022) demonstrates that when banks align their financial practices with green finance principles, their sustainability performance significantly improves.

The literature on green finance within banking, as explored by Zhang et al. (2022) and Zheng et al. (2021), underscores the importance of sustainable financial practices in achieving better environmental outcomes. Their findings suggest that the implementation of green finance

strategies leads to substantial improvements in the ecological performance of banking institutions, thereby fostering a more sustainable financial ecosystem.

H4: *There is a positive connection between green finance and environmental performance.*

2.5. Green Innovation and Sustainability Performance

Likewise, green innovation in this study can be known as a forward leap in the financial business, which can lessen inward and outside natural contamination. And assist saves finance with accomplishing ecologically economical turn of events. For instance, green banking, internet banking, portable banking, green ecological techniques, and green showcasing systems. As per the writing (Shahzad, Qu, Rehman, and Zafar (2022), green development can altogether further develop maintainability execution. Green development works on ecological execution and is connected with an organization's natural administration procedure. (Adegbile, Sarpong, & Meissner, 2017). Whereas, Xingyuan Wang, Zhao, and Bi (2021) and Kraus, Rehman, et al. (2020) found that environmental performance is influenced by green innovation. According to (Edeh, Obodoechi, and Ramos-Hidalgo (2020), who concentrated on supportability execution, green advancement prompts critical enhancements in trade execution. There has been an impressive examination of green development and monetary proficiency, with changing levels of accomplishment (Kraus, Rehman, et al., 2020).

H5: *There is a positive connection between green innovation and sustainable performance.*

2.6. Fintech and Financial Literacy

Studies showed that the utilization of fintech works on monetary consideration and monetary proficiency (Mulasiwi and Julialevi, 2020). Social acknowledgment of innovation is additionally upheld by two aspects (saw value and saw convenience) when individuals see its advantages and simplicity of use (Sulistiyarini, 2012; Shabbir et al 2026).

Morgan and Trinh (2019) study investigate the adoption of Fintech and the levels of financial literacy in Japan. Empirical research reveals that populations with higher digital engagement are more likely to embrace sustainable Fintech and e-money services. The survey underscores the public's need for increased awareness and self-education regarding the utilization of financial technology in managing their finances. Thus, financial education encompasses both awareness and comprehension. Building upon the preceding discussion, our study posits the following hypotheses.

H6: *There is a positive connection between financial literacy and Fintech.*

2.7 Mediation Role of Green Innovation and Finance

Green finance and green growth play a crucial role in improving the sustainability performance of organizations, reinforcing earlier discussions about the connections between financial technology, green initiatives, and sustainable outcomes. Despite this, current research has largely overlooked how integrating green finance and green growth within fintech influences the environmental performance of financial institutions (Guang-Wen & Siddik, 2023; Shabbir et al 2026; Dagunduro et al 2026). This study aims to fill that gap by exploring these dynamics specifically within banking firms operating in a green growth economy.

Moreover, research shows that green development fundamentally influences ecological execution (Ahmad, Scholz, AlDhaen, Ullah, & Scholz, 2021; Kraus, Rehman, et al., 2020; Xingyuan Wang et al., 2021). Moreover, Kraus, Rehman, et al. (2020) found that green advancement emphatically directs the relationship between corporate social and ecological execution. These outcomes propose that the relationship between fintech reception and natural execution in the financial business can be fundamentally improved by green finance and green advancement. No past exploration has analyzed the intervening job of green advancement and green finance on the relationship between fintech abilities and feasible execution.

H7: *There is a mediation role of green adoption between the association of Fintech adoption and the Environmental performance of banking institutions.*

H8: *There is a mediation role of green innovation between the association of Fintech adoption and the Environmental performance of banking institutions.*

2.8Moderation Effects of Financial Literacy

A moderate positive effect indicates that higher levels of financial literacy strengthen or accelerate the positive relationship between fintech adoption and green finance. In other words, banking institutions with more financially literate employees or shareholders may positively influence green finance while adopting fintech solutions (Kraus et al., 2020). Financially proficient people can more readily comprehend the liely advantages and dangers related to fintech reception and hence foster more viable execution procedures to help ecologically reasonable monetary practices (Wang et al., 2021). When people have an elevated degree of monetary proficiency, they can more readily comprehend the effects and potential open doors given by fintech reception concerning green innovation (Zhang et al. (2022). Informed choices. More effective asset use. Use strategies

and explore the monetary scene related to carrying out green and maintainable practices concerning advancement (Zheng et al, 2021).

H9: *There is a moderation effect of financial literacy on the relationship of fintech adoption and green finance.*

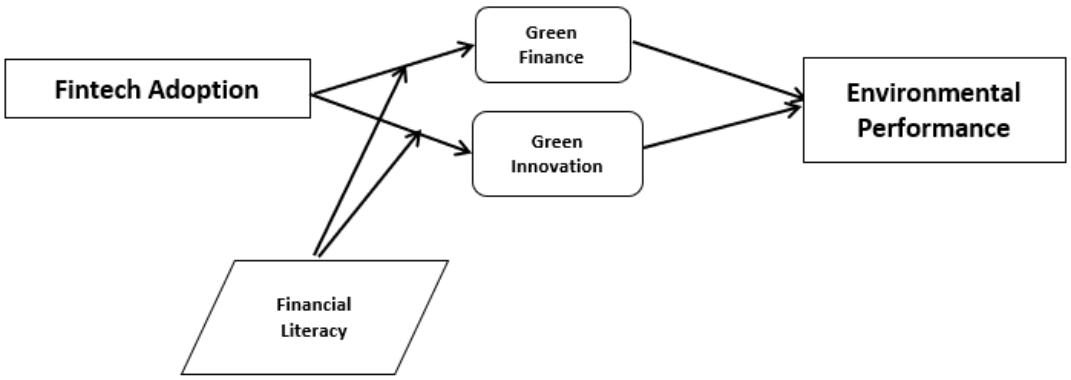
H10: *There is a moderation effect of financial literacy on the relationship of fintech adoption and green innovation.*

3. Material and Methods

3.1. Sample and Data Collection

This research adopts a quantitative approach and relies on primary data collection. Information was gathered through a structured questionnaire distributed to employees working in commercial banks across Pakistan. After removing incomplete or invalid responses, the study finalized a sample size of 302 participants. Prior to launching the full survey, a pilot study involving 25 randomly selected bank employees was carried out to ensure the reliability and clarity of the questionnaire. To examine the research hypotheses, Structural Equation Modeling (SEM) techniques were applied using SMART PLS software, following the guidelines of Ringle, Wende, and Becker. A commonly used 5-point Likert scale, ranging from 'strongly disagree' to 'strongly agree,' was utilized in the questionnaire to accurately capture participants' opinions. Prior to participation, all respondents were informed about the purpose, procedures, and voluntary nature of the study. Verbal consent was obtained from each participant due to the logistical challenges of obtaining written consent in a multi-branch banking environment. Participants were assured of confidentiality, anonymity, and the right to withdraw at any time without any consequences.

Figure 01: Research Framework



3.2. Reliability and Validity

3.2.1. Convergent Validity

The outcomes (as shown in table 01) show that Cronbach's alpha (CA) and composite reliability (CR) values were examined to evaluate the internal consistency of the construct. It is prescribed that these values surpass 0.60 to be viewed as sufficient. The findings, as introduced in Table 01, uncover that the α and CR values for all variables outperform the proposed edge of 0.60, confirming agreeable internal consistency inside the model. Additionally, the validity of the overview factors was assessed utilizing the typical average variance extracted (AVE). The AVE values went from 0.587 to 0.655, surpassing the edge of 0.50. Furthermore, the exact outcomes exhibit that the least and most elevated single variable loadings surpass the suggested worth of 0.50. Subsequently, this study approves the reliability.

Table 01: Convergent Validity

Variables	Items	Loadings	Alpha	CR	AVE
Environmental performance	EP1	0.846	0.864	0.902	0.587
	EP2	0.829			
	EP3	0.876			
	EP4	0.735			

	EP5	0.735			
Financial Literacy	FL1	0.877	0.882	0.914	0.655
	FL2	0.848			
	FL3	0.814			
	FL4	0.796			
	FL5	0.785			
Fintech Adoption	Fintech1	0.715	0.853	0.895	0.620
	Fintech2	0.775			
	Fintech3	0.853			
	Fintech4	0.826			
	Fintech5	0.794			
Green Finance	GF1	0.791	0.805	0.872	0.630
	GF2	0.824			
	GF4	0.786			
	GF5	0.773			
Green Innovation	GI1	0.797	0.88	0.913	0.626
	GI2	0.819			
	GI3	0.845			
	GI4	0.803			
	GI5	0.848			

3.2.2. Discriminant Validity

The researchers employed a widely recognized method known as the heterogeneity-single-characteristic (HTMT) relationship to assess the discriminant validity of the survey factors. The findings, as presented in Table 02, reveal that the HTMT values for all factors are below 0.85, indicating that the considered factors exhibit satisfactory discriminant validity (Henseler, Ringle, & Sarstedt, 2015).

Table 02: Discriminant Validity

Variables	Environmental Performance	Financial literacy	Fintech	Green Finance	Green Innovation
Environmental Performance	**0.765**				
Financial Literacy	0.625	**0.810**			
Fintech	0.661	0.721	**0.788**		
Green Finance	0.650	0.905	0.794	**0.794**	
Green Innovation	0.699	0.977	0.735	0.662	**0.791**

Table 03: Path Analysis

Hypothesis	Relationship	B	SD	t-statistics	p-values	Decision
H1	Fintech -> Environmental Performance	0.072	0.027	2.665	<0.05	Supported
H2	Fintech -> Green Finance	0.081	0.040	2.025	<0.05	Supported
H3	Fintech -> Green Innovation	0.070	0.016	4.375	<0.001	Supported

H4	Green Finance -> Environmental Performance	0.165	0.040	4.125	<0.001	Supported
H5	Green Innovation -> Environmental Performance	0.089	0.016	5.571	<0.001	Supported
H6	Financial Literacy -> Fintech	0.359	0.065	5.523	<0.001	Supported
H7	Fintech -> Green Finance -> Environmental Performance	0.151	0.037	4.081	<0.001	Supported
H8	Fintech -> Green Innovation -> Environmental Performance	0.140	0.031	4.516	<0.001	Supported
H9	Fintech*Financial Literacy -> Green Finance	0.128	0.054	2.376	<0.05	Supported
H10	Fintech*Financial Literacy -> Green Innovation	0.135	0.032	4.218	<0.001	Supported

4. Results and Discussion

According to (Ringle, Wende, & Becker, 2015), this study utilizes the SEM system (using SmartPLS variant 3.3.3) to inspect the relationship between fintech reception, green finance and monetary education, and green advancement. can go. There are many benefits to utilizing PLS-SEM. For instance, PLS-SEM beats relapse in assessing execution while testing arbiters(Preacher & Kelley, 2011; Cheisviyanny et al 2024; Hassan et al 2025). Partial Least Squares Structural Equation Modeling (PLS-SEM) integrates both metric and latent models. Additionally, a bootstrap method based on 5000 samples was employed to test the research hypotheses.

Table 03 underneath presents the results of a thorough investigation inspecting the connection between various factors. The coefficients (β) address the strength and heading of the connections, while the standard deviations (SD), t-statistics, and p-values offer bits of knowledge into the meaning of these connections. H1 sets a critical connection between fintech adoption and environmental performance, a relationship validated by the information (β = 0.072, p = <0.05). Likewise, H2 showed a critical connection between fintech adoption and green finance validated by the information (β = 0.081, p = <0.05). Besides, H3 showed a critical connection between fintech adoption and green innovation validated by the information (β = 0.070, p = <0.001).

Whereas, H4 showed a huge connection between green finance and environmental performance validated by the information (β = 0.165, p = <0.001). H5 showed a critical connection between green innovation and environmental performance validated by the information (β = 0.0.089, p = <0.001). H6 showed a huge connection between financial literacy and fintech adoption validated by the information (β = 0.359, p = <0.001). H7 demonstrated a critical job of green finance in fintech adoption and environmental performance validated by the information (β = 0.151, p = <0.001). Additionally, H8 demonstrated the mediating role of green innovation in the middle between fintech adoption and environmental performance validated by the information (β = 0.140, p = <0.001). Besides, H9 demonstrated a moderating effect on the relationship between fintech adoption and green finance validated by the information (β = 0.128, p = <0.05). Finally, H10 demonstrated the critical moderating role of financial literacy on the relationship between fintech adoption and green innovation validated by the information (β = 0.135, p = <0.001). Recent research highlights a strong and positive link between the adoption of fintech and improvements in environmental efficiency (EP). In other words, as fintech usage increases, so does environmental performance. This suggests that traits such as risk-taking, innovation, and proactive behavior are vital for the successful implementation of fintech solutions. These results align with earlier studies, reinforcing the idea that fintech significantly contributes to the profitability of Pakistan's banking sector (Guang-Wen & Siddik, 2023).

5. Conclusion and Implications

This research employed Structural Equation Modeling (SEM) techniques to explore how the adoption of financial technology (fintech) influences green finance and green innovation.

Additionally, the study analyzed the moderating role of financial literacy in these relationships. The results highlighted the positive impact of fintech adoption, emphasizing its significant contribution to advancements in green finance and innovation. Moreover, financial literacy expects a critical part, emphatically in the between fintech adoption, green finance, and innovation. Exceptionally, green finance and innovation go about as arbiter in the association between fintech adoption and performance. These perceptions underscore how financial innovation, environmentally friendly behaviors, and monetary outcomes are completely interrelated. It is turning out to be progressively vital for associations and policymakers to coordinate fintech arrangements with a green concentration as they explore the changing monetary services.

6. Limitations and Future Research Directions

The literature on the fintech adoption, green finance, green development, and financial education is enhanced by this study. Nevertheless, some limitations provide directions for further research. First off, it might be difficult to apply the findings to other developing countries or the financial industry due to the relatively small sample size (limited to 302 employees from Pakistani banking institutions). Future studies should use larger and more varied samples from different countries and industries to address this. Second, while the pandemic's effects on the fintech adoption, green finance, and monetary culture are the focus of this study, with green development serving as a mediator, other mediating factors should also be investigated. We could improve our understanding by investigating variables like employee attitudes, environmental processes, and data on technological innovation.

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Reference

1. Abdalla, A. A., Shabbir, M. S., FOTACHE, G., Georgiana-Tatiana, B., Jaradat, M., Al Qassem, A., ... & Florin, R. (2025). Geoclimatic and Socioeconomic Influences on Water Use Efficiency in Cotton Crops Productivity: A Sustainable Business and Management Farming Perspective. *Research on World Agricultural Economy*, 205-217.
2. Adegbile, A., Sarpong, D., & Meissner, D. (2017). Strategic foresight for innovation management: A review and research agenda. International Journal of Innovation and Technology Management, 14(04), 1750019.
3. Ahmad, N., Scholz, M., AlDhaen, E., Ullah, Z., & Scholz, P. (2021). Improving Firm's economic and environmental performance Through the sustainable and innovative environment: evidence from an emerging economy. Frontiers in Psychology, 12, 651394.
4. Al Nawayseh, M. K. (2020). Fintech in COVID-19 and beyond: what factors are affecting customers' choice of fintech applications? Journal of Open Innovation: Technology, Market, and Complexity, 6(4), 153.
5. Alaassar, A., Mention, A.-L., & Aas, T. H. (2023). Facilitating innovation in FinTech: a review and research agenda. Review of Managerial Science, 17(1), 33-66.
6. Arnaboldi, F., & Rossignoli, B. (2015). Financial innovation in banking. Bank risk, governance and regulation, 127-162.
7. Aslam, E., Shabbir, M. S., Iqbal, A., Jaradat, M., Alhebri, A., Aldawsari, S. H., ... & Said, L. R. (2026). The Impact of Service Quality on Halal Purchase Decisions: A Study on Customer Satisfaction and Word of Mouth. *Journal of Islamic Monetary Economics and Finance*, *12*(2).
8. Aslam, M. A., Li, Z., Shabbir, M. S., PĂUNESCU, L. M., Jaradat, M., Nazir, H., & SINISI, C. I. (2026). Synergistic effects of supplier resilience, information sharing, inventory management, and flexibility on supply chain resilience: a PLS-SEM and NCA approach. *Humanities and Social Sciences Communications*. https://doi.org/10.1057/s41599-026-06801-3
9. Aslam, M. A., Li, Z., Jaradat, M., Shabbir, M. S., Lile, R. A., & Nazir, H. (2026). Revealing FMCG Success in Pakistan: The Nexus of Supply Chain Practices and Competitive Advantage. *Global Business Review*, *27*(1), 9-36.
10. Aslam, E., Iqbal, A., & Shabbir, M. S. (2025). Intellectual capital and financial stability of Islamic banks in OIC countries: the moderating role of corporate governance. *Journal of Islamic Accounting and Business Research*.

11. Atan, R., Razali, F. A., Said, J., & Zainun, S. (2016). Environmental, social and governance (ESG) disclosure and its effect on firm's performance: A comparative study. International Journal of Economics and Management, 10(2), 355-375.
12. Awawdeh, A. E., Ananzeh, M., El-khateeb, A. I., & Aljumah, A. (2021). Role of green financing and corporate social responsibility (CSR) in technological innovation and corporate environmental performance: a COVID-19 perspective. China Finance Review International, 12(2), 297-316.
13. Ayadi, M. A., Ayadi, N., & Trabelsi, S. (2019). Corporate governance, European bank performance and the financial crisis. Managerial Auditing Journal, 34(3), 338-371.
14. Barbu, C. M., Florea, D. L., Dabija, D.-C., & Barbu, M. C. R. (2021). Customer experience in fintech. Journal of Theoretical and Applied Electronic Commerce Research, 16(5), 1415-1433.
15. Bertinetti, D., Schweinsberg, S., Hanke, S. E., Schwede, F., Bertinetti, O., Drewianka, S., . . . Herberg, F. W. (2009). Chemical tools selectively target components of the PKA system. BMC chemical biology, 9, 1-15.
16. Brogi, M., & Lagasio, V. (2019). Environmental, social, and governance and company profitability: Are financial intermediaries different? Corporate Social Responsibility and Environmental Management, 26(3), 576-587.
17. Buallay, A. (2019). Is sustainability reporting (ESG) associated with performance? Evidence from the European banking sector. Management of Environmental Quality: An International Journal, 30(1), 98-115.
18. Chen, J., Siddik, A. B., Zheng, G.-W., Masukujjaman, M., & Bekhzod, S. (2022). The effect of green banking practices on banks' environmental performance and green financing: an empirical study. Energies, 15(4), 1292.
19. Cheisviyanny, C., Dwita, S., Helmy, H., Marta, J., Rasli, A., & Yumna, A. (2024, November). Social Capital and Stakeholders' Contribution to Business Survival During COVID-19: A Case Study. In *The Global Conference on Entrepreneurship and the Economy in an Era of Uncertainty* (pp. 927-941). Singapore: Springer Nature Singapore.
20. Dagunduro, M. E., Oluwagbade, O. I., Awotomilusi, N. S., Shabbir, M. S., Hamad Aldawsari, S., Haddad, A. M., & Jaradat, M. (2026). Governance Mechanisms, Institutional Quality, and Financial Reporting Excellence: Evidence from Financial Institutions in Emerging Economies. *F1000Research*, *15*, 1095.
21. Dorfleitner, G., Hornuf, L., Schmitt, M., Weber, M., Dorfleitner, G., Hornuf, L., . . . Weber, M. (2017). Definition of FinTech and description of the FinTech industry. FinTech in Germany, 5-10.
22. Dorfleitner, G., Priberny, C., & Röhe, M. (2017). Why do microfinance institutions fail socially? A global empirical examination. Finance Research Letters, 22, 81-89.
23. Dwivedi, P., Alabdooli, J. I., & Dwivedi, R. (2021). Role of FinTech adoption for competitiveness and performance of the bank: A study of banking industry in UAE. International Journal of Global Business and Competitiveness, 16(2), 130-138.
24. Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., . . . Ahuja, M. (2023). "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. International Journal of Information Management, 71, 102642.
25. Edeh, J. N., Obodoechi, D. N., & Ramos-Hidalgo, E. (2020). Effects of innovation strategies on export performance: New empirical evidence from developing market firms. Technological Forecasting and Social Change, 158, 120167.
26. Fahamsyah, M. H., Zaki, I., Laila, N., & Shabbir, M. S. (2025). Profit Loss Sharing Problems in the Banking Industry in Indonesia. *MALIA*, *16*(2), 444-469.
27. Gonenc, H., & Scholtens, B. (2017). Environmental and financial performance of fossil fuel firms: A closer inspection of their interaction. Ecological Economics, 132, 307-328.
28. Guang-Wen, Z., & Siddik, A. B. (2023). The effect of Fintech adoption on green finance and environmental performance of banking institutions during the COVID-19 pandemic: the role of green innovation. Environmental Science and Pollution Research, 30(10), 25959-25971.
29. Haq, M., & Heaney, R. (2012). Factors determining European bank risk. Journal of International Financial Markets, Institutions and Money, 22(4), 696-718.
30. Hassan, A., Ibrahim, R. L., Raimi, L., Omokanmi, O. J., & S Senathirajah, A. R. B. (2025). Balancing growth and sustainability: can green innovation curb the ecological impact of resource-rich economies?. *Sustainability*, *17*(10), 4579.
31. Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. Journal of the academy of marketing science, 43, 115-135.

32. Indriastuti, M., & Chariri, A. (2021). The role of green investment and corporate social responsibility investment on sustainable performance. Cogent Business & Management, 8(1), 1960120.
33. Kraus, S., Clauss, T., Breier, M., Gast, J., Zardini, A., & Tiberius, V. (2020). The economics of COVID-19: initial empirical evidence on how family firms in five European countries cope with the corona crisis. International journal of entrepreneurial behavior & research, 26(5), 1067-1092.
34. Li, Z., Deng, X., & Peng, L. (2020). Uncovering trajectories and impact factors of CO2 emissions: a sectoral and spatially disaggregated revisit in Beijing. Technological Forecasting and Social Change, 158, 120124.
35. Nawaz, S., Makin, F., Bashir, T., Habib, Q., Shabbir, M. S., & Aslam, E. (2025). Cultural Norms and Safety Management: Understanding Honour Killing in Pakistan. *Journal of Asian Development Studies*, *14*(2), 958-970.
36. Nawaz, S., Bashir, T., Habib, Q., & Shabbir, M. S. (2024). Educational management and marriage status: Transforming domestic life for women. *iRASD Journal of Educational Research*, *5*(1), 91-98.
37. Nawaz, S., Bashir, T., Habib, Q., & Shabbir, M. S. (2024). The invisible chains: Domestic violence and women's rights in Pakistan. *Pakistan Journal of Humanities and Social Sciences*, *12*(4), 3328-3337.
38. Palmié, M., Wincent, J., Parida, V., & Caglar, U. (2020). The evolution of the financial technology ecosystem: An introduction and agenda for future research on disruptive innovations in ecosystems. Technological forecasting and social change, 151, 119779.
39. Sadiq, M., Kumar, R., Kumari, R., Neogi, D., Shahzad Shabbir, M., Alhebri, A., ... & Zamir, A. (2026). Economic Integration and Trade Openness in QUAD Nations: Empirical Evidence from Panel Cointegration and ARDL Models. *Global Business Review*, 09721509261441791.
40. Saleem, H., Khan, M. B., Shabbir, M. S., Paraschivescu, A. O., Radu, F., Bordeianu, G. D., ... & Jaradat, M. (2026). Moving towards sustainable environment: Unveiling the nexus of public private partnerships and technological innovation for green energy transition and environmental quality. Sustainable Futures, 12, 102055.
41. Shabbir, M. S., & Putra, R. D. (2026). Dual Monetary Transmission and Real Sector Dynamics: Comparative Evidence from Islamic and Conventional Policies in Indonesia. *Journal of Islamic Finance and Economic Studies*, *2*(1), 19-35. https://doi. 10.64268/jifes.v2i1.151.
42. Shabbir, M. S., Mia, M. M., Jaradat, M., Alhebri, A., Zayed, N. M., Ogbu Edeh, F., ... & Bansal, A. (2026). The Influence of Crowd Wisdom on Entrepreneurial Intention: Evidence from a Second-Order CB-SEM Model. *F1000Research*, *15*, 877.
43. Shabbir, M. S., Karim, F., Zayed, N. M., Monir, M. S., Bipasha, M. S., Edeh, F. O., … Said, L. R. (2026). Cybersecurity Awareness among Women and Youth E-commerce Entrepreneurs in Bangladesh: An Exploratory Factor Analysis. International Review of Management and Marketing, 16(5), 333–346. https://doi.org/10.32479/irmm.23988
44. van den Bergen, J. C., Hiller, M., Böhringer, S., Vijfhuizen, L., Ginjaar, H. B., Chaouch, A., . . . Cirak, S. (2015). Validation of genetic modifiers for Duchenne muscular dystrophy: a multicentre study assessing SPP1 and LTBP4 variants. Journal of Neurology, Neurosurgery & Psychiatry, 86(10), 1060-1065.
45. Vives, X. (2019). Digital disruption in banking. Annual Review of Financial Economics, 11, 243-272.
46. Wang, K., Jia, Z., Bao, L., Wang, L., Cao, L., Chi, H., . . . Jiang, Y. (2022). Memory B cell repertoire from triple vaccinees against diverse SARS-CoV-2 variants. Nature, 603(7903), 919-925.
47. Wang, X., Sadiq, R., Khan, T. M., & Wang, R. (2021). Industry 4.0 and intellectual capital in the age of FinTech. Technological Forecasting and Social Change, 166, 120598.
48. Wang, X., Zhao, H., & Bi, K. (2021). The measurement of green finance index and the development forecast of green finance in China. Environmental and Ecological Statistics, 28, 263-285.
49. Weng, H.-H., Chen, J.-S., & Chen, P.-C. (2015). Effects of green innovation on environmental and corporate performance: A stakeholder perspective. Sustainability, 7(5), 4997-5026.
50. Xiong, Q., & Sun, D. (2022). Influence analysis of green finance development impact on carbon emissions: an exploratory study based on fsQCA. Environmental Science and Pollution Research, 1-12.
51. Yan, C., Siddik, A. B., Akter, N., & Dong, Q. (2021). Factors influencing the adoption intention of using mobile financial service during the COVID-19 pandemic: The role of FinTech. Environmental Science and Pollution Research, 1-19.
52. Zhang, X., Wang, Z., Zhong, X., Yang, S., & Siddik, A. B. (2022). Do green banking activities improve the banks' environmental performance? The mediating effect of green financing. Sustainability, 14(2), 989.

53. Zheng, G., Siddik, A., Masukujjaman, M., Fatema, N., & Alam, S. (2021). Green Finance Development in Bangladesh: The Role of Private Commercial Banks (PCBs). Sustainability 2021, 13, 795. In: s Note: MDPI stays neu-tral with regard to jurisdictional clai-ms in ….
54. Zheng, G.-W., Siddik, A. B., Masukujjaman, M., & Fatema, N. (2021). Factors affecting the sustainability performance of financial institutions in Bangladesh: the role of green finance. Sustainability, 13(18), 10165.
55. Zheng, G.-W., Siddik, A. B., Masukujjaman, M., Fatema, N., & Alam, S. S. (2021). Green finance development in Bangladesh: The role of private commercial banks (PCBs). Sustainability, 13(2), 795.