Examining the Influence of Fintech Adoption on Green Finance and Environmental Performance in Financial Institutions: Exploring the Mediating Role of Green Innovation

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ABSTRACT

Technological advancements are integral in achieving the sustainability goals of a nation. In the financial sector, technology-integrated Fintech Adoption (FA) is considered a revolutionary change in financial services delivery. Substantial empirical evidences exist to establish how the Environmental Performance (EP) of the organizations is affected by Green Innovation (GI) and Green Finance (GF). In the finance sector, only limited researches were carried out to understand the relationship between Environmental Performance, Fintech Adoption, Green Innovation and Green Finance. The present study was undertaken among the financial institutions in the Bagmati province of Nepal. The empirical research findings endorse that the Adoption of Fintech significantly impact Green Innovation, Environmental Performance and Green Finance. The study also confirmed that a firm's Environmental Performance is significantly affected by Green Finance and Green Innovation. The researchers established the mediating effect of Green Innovation in the association among the variables Adoption of Fintech, Environmental Performance and Green Finance. The study confirms that in enhancing the Environmental Performance of the financial institutions, Green Innovation, Fintech Adoption, and Green Finance play a crucial role.

Keywords: Environmental Performance, Fintech, Green Innovation, Green Finance, Financial Institutions
JEL Classifications: G00, G20, O33, Q50, Q55

1. INTRODUCTION

Following the period of the COVID-19 pandemic, in escalating the environmental performance, predominant attention has been noted in the financial sector (Raphael, 2021; Siddik and Zheng, 2021). The crisis resulted in the integration of technological innovations, including Green Finance and Fintech, in smoothening the financial operations of the firms. During the pandemic, in the delivery of financial services, firms adopted Fintech to avoid physical contact (Yan et al., 2021). To attain the noble objective of sustainability as per Sustainable Development Goals (SDGs) and the Paris Agreement, the integration of financial technology is crucial for

stakeholders and policymakers (Nassiry, 2019). Incorporation of technological advancements and eco-friendly projects can lead to the accomplishment of economic and environmental sustainability in the financial sector (Akter et al., 2018; Zheng et al., 2021a, b). Even though technological integration escalated the attainment of sustainability objectives of the financial firms, the contributing factors to this scenario remain unexplored. The current research explores the crucial factors of Environmental Performance (EP) of financial firms in developing countries.

In the pursuit of sustainability objectives of the firm's technological innovations play an integral role (Ozturk et al., 2022; Awawdeh

et al., 2022; Kraus et al., 2020). The application of Fintech supported by technology integration is considered a revolution in delivering financial services by the firms operating in this sector (Dorfleitner et al., 2017; Dwivedi et al., 2021). Green finance technologies act as a catalyst in facilitating the fund flow to environmentally friendly projects that accelerate the economic and environmental sustainability of the firms. The inclusion of these technological advancements with green innovation (GI) is expected to reduce the detrimental environmental effects to a considerable extent and to elevate environmental protection (Li et al., 2020; Kraus et al., 2020).

Though various research studies were conducted to assess the impact of green innovation and green finance on the environmental outcomes of the corporates, there exists a research gap in the perspective of financial institutions in identifying the relation among financial accessibility, green innovation, green finance and firms' environmental performance. Therefore, the present study intends to bridge this research gap by analyzing the association among the variables of Green Finance, Green Innovation, firms' Environmental Performance and the Adoption of Fintech in the finance sector, focusing on the potential mediating impact of Green Innovation in attaining firms' Environmental Performance. While addressing the research objectives, researchers aim to contribute comprehensive insights in the interconnection among adoption of Fintech, green finance, financial innovation and firms' environmental performance. This research also aims to provide theoretical and practical insights to the policy makers and other stakeholders in the financial sector for the long-term sustainability of financial institutions.

2. LITERATURE REVIEW

2.1. Fintech and Environmental Performance

Driven by the increasing demand for mass customization and eco-friendly products and services, Fintech has emerged as a focus point among corporate experts in the financial sector. Integration of Fintech could leverage the expedition of service delivery and service offerings of the financial institutions (Dwivedi et al., 2021). Previous literatures underscore the role of technology integration in determining financial accessibility and environmental performance, which are considered to be crucial in measuring the competitiveness of financial firms (Awawdeh et al., 2022; Dwivedi et al., 2021). An established relationship exists between the integration of technology and firms' environmental sustainability; also, many studies suggest the adoption of technological advancements to bolster environmental performance (Severo et al., 2019).

H_1: "Environmental Performance of the Financial Institutions is significantly affected by Fintech Adoption."

2.2. Fintech Adoption, Green Innovation, Green Finance

Researchers established that firms' environmental performance and technology integration is significantly affected by CSR initiatives and green finance (Awawdeh et al., 2022). Energy efficiency can be enhanced by integrating green finance technologies by supporting the invention of advanced energy technologies and guiding the policy makers in optimizing energy structures and enhancing sustainability (Peng and Zheng, 2021; Dorfleitner and Braun, 2019). Researchers established the leveraging role of Fintech in integrating green finance technologies, including blockchain, big data, internet of things and artificial intelligence, which plays a crucial role in the attainment of sustainable development goals (Nassiry, 2019). Through investments and lending, financial technologies escalate green economic growth (Zhou et al., 2022). In growing economies, financial accessibility significantly contributes to green finance and the green innovation of banks and other financial institutions (Yan et al., 2022). The interrelationship between green innovation and green finance is amplified by green structures and green insurance. The above literatures conclude that GI, FA and GF have been pivotal in fostering the environmental sustainability of a firm.

H_2: "There is a significant association between Fintech Adoption and Green Finance of the Financial Institutions."

H_3: "There is a significant association between Fintech Adoption and Green Innovation of the Financial Institutions."

H_4: "There is a significant association between Green Finance and Green Innovation of the Financial Institutions."

2.3. Green Finance and Environmental Performance

Researches corroborated the positive correlation between the variables environmental performance and green finance with ample evidences. It was reported that companies that adopted green finance technologies reflected better environmental results (Zhang et al., 2022), (Xu et al., 2020), (Awawdeh et al., 2022; Guang-Wen and Siddik, 2022). Xu et al. (2020) confirmed the potential effect of green finance on the green performance of the firms. Researchers also pointed out that green investment improves the sustainability and financial performance of firms (Indriastuti and Chariri, 2021). It was suggested that realizing environmental sustainability may come at the cost of investment risk, especially at higher revenue levels (Alola and Ozturk, 2021).

H_5: "There is a significant association between Green Finance and Environmental Performance of the Financial Institutions."

2.4. Green Innovation and Environmental Performance

Green innovation embraces the integration of technological advancements focused on the mitigation of air pollution, non-renewable energy consumption, environmental degradation, waste disposal and other adverse impacts on the environment. Green technology fosters the creation and dissemination of practices to attain sustainability by mitigating the adverse effects of business and commerce on the environment and by promoting sustainable business practices (Ali et al., 2021; Kraus et al., 2020). Adegbile et al. (2017) observed that inculcating GI into an organization's eco-friendly policies leads to enhanced environmental performance.

Researchers also pointed out that Green innovation significantly reduces a firm's detrimental environmental effects and enhances the income through advanced waste and cost management (Weng et al., 2015; Zhang et al., 2021). Substantiate the findings of Wang et al. (2021); (Ali et al., 2021); Kraus et al. (2020) demonstrated the effect of GI on the EP.

H_6: "There is a significant association between Green Innovation and Environmental Performance of the Financial Institutions."

2.5. Mediating Role of Green Innovation

Researchers established that green innovation is a significant factor influencing environmental performance of the firms (Ahmad et al., 2021; Zhang et al., 2021; Wang et al., 2021). The influencing role of sustainable finance on firms' green innovation is also validated in previous researches (Wang et al., 2022). Many researches validated the impact of green innovation in mediating the association among the variables of Adoption of Fintech, green finance and environmental performance. Also, it was confirmed by the researchers that by integrating green innovation, a firm's environmental performance can be bolstered (Zheng and Siddik, 2022). Previous studies also pointed out the mediating effect of green innovation on firms' CSR initiatives and environmental performance (Kraus et al., 2020). These studies established the significant effect of GI in the association among the variables FA, GF, and EP of financial institutions.

H_7: "Green Innovation significantly mediates the association between Fintech adoption and Environmental Performance of the financial institutions."

H_8: "Green Innovation significantly mediates the association between Green Finance and the Environmental Performance of the financial institutions."

3. RESEARCH METHODOLOGY

The researcher employed the existing scale to measure environmental performance (EP), green innovation (GI), Fintech Adoption (FA) and Green Finance (GF). The scale validated by Yan et al. (2021), Al Nawayseh (2020), and Hu et al. (2019) was employed to measure Fintech Adoption. In the measurement of the variable Green Finance, the scale developed by Zheng and Siddik and Zhang et al. (2022) was used. The existing scale by Kraus et al. (2020) and Tang et al. (2018) was employed to measure Green innovation. The scale developed by Suganthi (2020), Kraus et al. (2020), and Zhang et al. (2022) was used in the measurement of the endogenous variable Environmental Performance. Structured questionnaire responses were collected from the employees in the financial institutions in the Bagmati province of Nepal. The fully filled 462 responses among the 521 questionnaires distributed by random sampling were analyzed using PLE-SEM. To establish the nonexistence of Common Method Bias (CMB), Harman's single-factor technique was employed. As a single factor explains 36.7% of the total variance, the non-existence of CMB is confirmed (Conway and Lance 2010, Kraus et al., 2020).

4. DATA ANALYSIS AND INTERPRETATION

Tests of validity and reliability were conducted by the researchers to confirm the validity of the constructs. (Hair et al., 2012) As the factor loading values exceeded the minimum threshold limit of 0.5, construct reliability and validity were established. The internal consistency of the constructs was verified using composite reliability (CR) and Cronbach's alpha (CA), and it was identified that both CA and CR values satisfy the standards recommended (Hair et al., 2016; Bagozzi and Yi, 1988). Average variance explained (AVE) was employed to ensure the Constructs' convergent validity, and it was observed that all the values fall above the recommended standard of 0.5. Discriminant validity

of the dimensions was established by the researchers using the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) correlation ratio. It was identified that the relation between each group of constructs did not surpass the root square of their Average Variance Explained and all HTMT values fall below 0.85, establishing the discriminant validity (Hair et al., 2010; Fornell and Larcker, 1981; Henseler et al., 2009; Henseler et al., 2015). The non-existence of multicollinearity was confirmed using the variance inflation factor (VIF), and it was found that the VIF values were <5. The discriminant validity of the constructs are represented in Table 1.

The predictive relevance of the PLS path was confirmed using the model blindfolding procedure by the researchers (Geisser, 1974; Stone, 1974; Preacher et al., 2004; Ringle et al., 2015; Hair et al., 2019). The Q^2 values of the variables were more than the recommended threshold limit of 0, confirming the predictive relevance effect of the model (Chin, 2001). The effect size f^2 value reveals that the Adoption of Fintech has only a minimal influence on EP (0.07) and GI (0.089) and a significant influence on GF (0.497). Conversely, GF demonstrated a minor effect size on EP (0.085) and GI (0.133), which is consistent with the effect of GI on EP (0.108) (Cohen, 2013).

4.1. Evaluation of the Structural Model

To validate the research hypotheses, path analysis and structural equation modeling were used. Evaluation of the developed model revealed that the proposed model could explain 35% of the variation in Green Innovation, 36.2% of the variation in Green Finance and 47.7% of the variation in Environmental Performance. The findings of the research hypotheses illustrated in Table 2 indicate that FA significantly impacts EP ($\beta = 0.280$, $P < 0.000$),

Table 1: Discriminant validity

Constructs	Env. performance	Fintech	Green finance	Green innovation
Fornell-larker criterion				
Env. performance	0.761			
Fintech adoption	0.542	0.727		
Green finance	0.556	0.526	0.786	
Green innovation	0.546	0.510	0.532	0.797
HTMT criterion				
Env. performance				
Fintech adoption	0.652			
Green finance	0.623	0.659		
Green innovation	0.742	0.675	0.681	

Source: Authors compilation

Table 2: OLS regression results

Path	β	t-value	P-value	Result
FA>EP	0.214	4.775	0.000	Significant
FA>GF	0.612	9.914	0.000	Significant
FA>GI	0.367	5.253	0.000	Significant
GF>GI	0.358	5.710	0.000	Significant
GF>EP	0.321	6.411	0.000	Significant
GI>EP	0.294	5.712	0.000	Significant
FA>GI>EP	0.399	4.951	0.000	Significant
GF>GI>EP	0.113	4.573	0.001	Significant

Source: Authors compilation
FA: Fintech adoption, EP: Environmental performance, GF: Green finance, GI: Green innovation

GF ($\beta = 0.593$, P = 0.000), and GI ($\beta = 0.421$, P = 0.000), which establishes the first three hypotheses. Additionally, GF exhibits a significant and positive impact on GI ($\beta = 0.348$, P = 0.000) and EP ($\beta = 0.297$, P = 0.001), establishing H_4 and H_5. Consistent with H_6, research findings demonstrate that GI influences EP significantly, with β-value 0.391 and a P = 0.000. The results are depicted in Tables 2 and 3. Figures 1 and 2 represents Measurement Model and structural model respectively.

Table 3: Structural path coefficient

Path	β	t-value	P-value	Result
FA>EP	0.280	5.745	0.000	***
FA>GF	0.593	7.954	0.000	***
FA>GI	0.421	6.253	0.000	***
GF>GI	0.348	5.760	0.000	***
GF>EP	0.297	8.421	0.001	***
GI>EP	0.391	5.912	0.000	***
FA>GI>EP	0.399	3.951	0.000	***
GF>GI>EP	0.113	3.963	0.001	***

Source: Authors compilation. ***Significant
FA: Fintech adoption, EP: Environmental performance, GF: Green finance, GI: Green innovation

To verify the mediating impact of GI on the variables FA, GF and EP, variance accounted for (VAF) was employed. It was observed that a VAF value of 67.9% indicates the partial mediation effect of GI on the association between FA and EP, which established hypothesis 7. GI was also found to partially mediate the association between GF and EP with a 41% mediation effect, thus confirming hypothesis 8. PLS-SEM and OLS regression models were used to confirm the robustness of the research findings. The results of these two models of the study established all the proposed hypotheses. The outcomes of the measurement model and model effect size are illustrated in Tables 4 and 5 respectively.

5. DISCUSSION

The empirical findings of the study confirm the hypothesized impact of Fintech Adoption (FA) on the environmental performance (EP) of financial institutions. FA catalyses the sustainable business practices of the financial firms through the integration of technological innovations, including mobile and digital banking, paperless banking and financial inclusion in rural
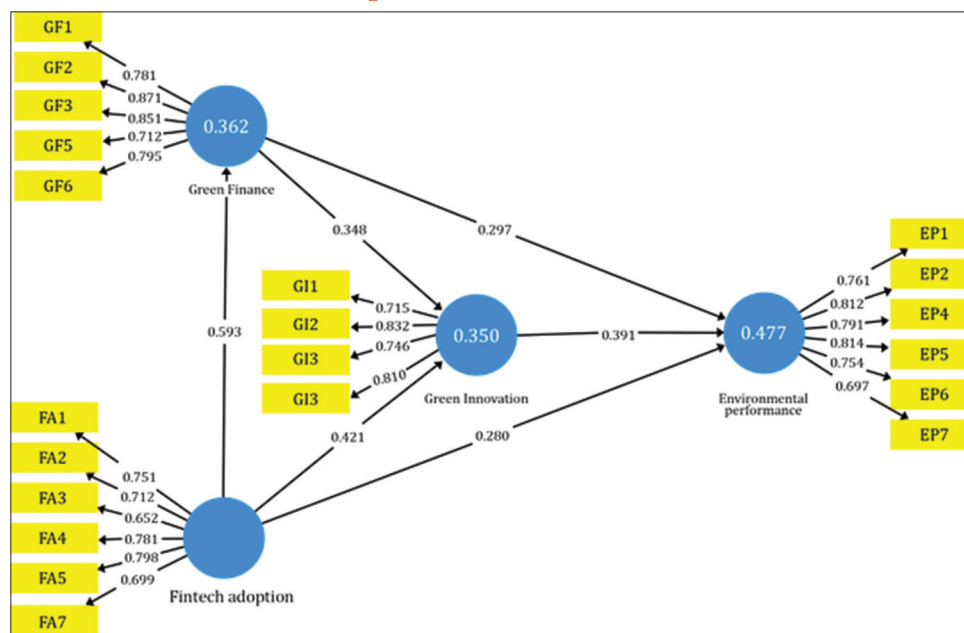
Figure 1: Measurement model
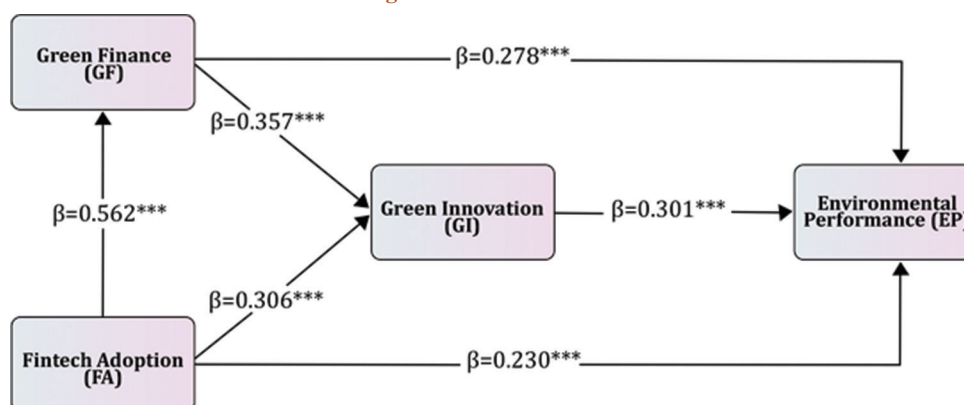

Figure 2: Structural model

Table 4: Measurement model outcomes

Variables	Constructs	FL	CA	CR	AVE	R²
Environmental performance (EP)	EP1	0.761	0.871	0.881	0.591	0.477
	EP2	0.812				
	EP4	0.791				
	EP5	0.814				
	EP6	0.754				
	EP7	0.697				
Fintech. adoption (FA)	FA1	0.751	0.812	0.894	0.572	
	FA2	0.712				
	FA3	0.652				
	FA4	0.781				
	FA5	0.798				
	FA7	0.699				
Green finance (GF)	GF1	0.781	0.851	0.915	0.672	0.362
	GF2	0.871				
	GF3	0.851				
	GF5	0.712				
	GF6	0.795				
Green innovation (GI)	GI1	0.715	0.752	0.863	0.619	0.35
	GI2	0.832				
	GI3	0.746				
	GI4	0.810				

Source: Authors compilation

Table 5: Model effect size

Constructs	Env. performance	Green finance	Green innovation
Fintech adoption	0.07	0.497	0.089
Green finance	0.085		0.133
Green innovation	0.108		

Source: Authors compilation

areas. This study finding underscores the opinion of Awawdeh et al. (2022) and Dwivedi et al. (2021) that to enhance the efficiency in the financial sector and to bolster the EP technology integration is crucial. The present research confirms the significant relationship between Fintech Adoption (FA) and Green Finance (GF), showing that FA can escalate GF by promoting access to funding sources, including digital financing. Guang-Wen and Siddik (2022) also established that Green Finance initiatives and Fintech adoption are positively correlated in financial institutions. This result supports the observation of Mirza et al. (2023) that there is a significant association between the investments in Green Finance technologies and Fintech, attributing to search, implementation and the monitoring of new technology implementation. Similar findings were established by Cen and He (2018).

The present study findings on the relationship between FA and GI confirm the findings of Li et al. (2022) that Green Innovation is positively influenced by Financial Inclusion. The existence of a similar association between these two factors was evident from the studies of Xue et al. (2022) and Xiong and Sun (2022). The empirical results of the association between GI and GF endorse that GF significantly contributes to GI, and across various alternative estimators, these effects remain consistent (Irfan et al., 2022). The study confirms the hypothesized impact of GF on EP. A favorable association between these two factors was reported by Zhang et al., Chen et al., 2022. These outputs are also in agreement with the previous studies, which reported that for enhancing environmental performance, green finance and renewable sources of energy are

crucial (Khan et al., 2022). The positive association between GI and EP has been established in the study. This supports the previous arguments that green innovation is a significant contributor to organizational and environmental performance (Ahmed et al., 2023). The mediation analysis established the partial mediating effect of GI in the association between EP and GF. The analysis of the paths also confirmed the mediating effect of GI in the relationship between FA and EP. This implies that GF and FA can significantly contribute to the GI of financial institutions, which eventually results in the escalated EP of the firms. From the empirical findings and previous literature, the study suggests the adoption of technology-integrated sustainable innovations to bolster the environmental performance of the firms.

6. CONCLUSION

The empirical results of the study endorse the crucial influence of the Adoption of Fintech on Green Innovation, Green Finance and Environmental Performance. The study also confirmed that firms' Environmental Performance is significantly affected by Green Innovation and Green Finance. Green Innovation partially mediates the association among Fintech Adoption, Green Finance and firms' Environmental Performance. The study underscores the critical contributions of the Adoption of Fintech, Green Innovation and Green Finance in attaining enhanced Environmental Performance while advocating for the finance sector to focus on the adoption of innovation in financial technology and green financing into their operations to accelerate the environmental performance of the firms. It is expected that the financial institutions can contribute to the sustainability goals of a country by integrating technological innovations, investing in pro-environmental projects and ensuring inclusive banking operations.

To verify the generalizability of the findings, the study suggests further research in other countries and sectors. Research endeavors exploring alternative facilitators, accelerators, and catalysts for promoting environmental sustainability are also recommended by the researchers.

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