

ESG PRACTICES AND CORPORATE DIVIDEND DECISION: A MODERATED MEDIATING ANALYSIS

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Abstract *The study examines the direct and indirect roles of CEO efficiency and firm reputation respectively, in order to investigate the relationship between ESG practices and corporate dividend decisions of the Indian companies. The data is collected from NSE Nifty 500 and S&P BSE 500 index of the Indian listed firms during the period 2013 to 2022. The study also aims in addressing the drawbacks of the previous literature who assumes the direct relationships of the ESG disclosure on corporate dividend decisions which are inconclusive. Using the fixed effect model and structural equation model, the study demonstrates favourable and substantial correlations between ESG practices and dividend decisions that are conveyed through the corporate reputation. Further, through the application of the Instrument Variable Two Stage Least Square (2SLS IV) regression approach, CEO's efficiency amplifies the insignificant impact of ESG disclosure on the company's reputation. The results report that company reputation is a matter of stakeholders' perceptions and reputation is distinct from the actual character and behaviour of the companies with the longitudinal data. The outcome of the study offers insights into how lack of consideration of factors results in inconsistent findings as reported in the previous literature.*

Keywords: *ESG Practices, Dividend Policy, Instrument Variable Two Stage Least Square (2SLS IV) Regression, Firm Reputation, CEO Efficiency*

INTRODUCTION

The central objective of organisations in finance is dividend decision. Many ideas and a tonne of literature concentrate on how governance and financial characteristics affect dividend distributions (Chae et al., 2009; Kim, 2021; Shah, 2019). Recent tendencies towards social and environmental issues have an impact on corporate practices and tend to represent a significant paradigm shift. ESG (environment, social, and governance) policies that address how corporate resources are allocated recognise the difficulties facing both management and investors. Also, the received appreciation of the ESG policies by investors and society sets new priorities for the corporate and investment goals intended to enhance sustainability practices (Johansson & Fahlen, 2019). In light of this, financial conflicts between companies' decisions to adopt ESG practices and their obligations to pay dividends to investors have emerged.

Furthermore, incentives, ESG policies, rules, social responsibility, and corporate governance measures encourage revolutions in India's ESG practices. Sustainability practices evaluated by the ESG score and its disclosure familiarise investors with the ESG's standard parameters, which in turn encourages the adoption of ESG practices by businesses, investors, and other stakeholders. On the other hand, businesses that are transparent and adhere to stricter requirements for revealing their ESG practices perform better. This will result in the creation of long-term value that helps to draw the quality capital and investment. The latter side critical approach has been observed in the rising spectre of "greenwashing" whereby firms deliberately showcase social services only for better performance which may not be implemented and hide the poor performance (Brooks & Oikonomous, 2018). Burritt and Schaltegger (2010) evidenced that in the voluntary disclosure firm only discloses the information that presents a

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favourable picture. Contrarily, the critical approach also contends that failure by corporations to disclose their ESG policies may harm investors' interests, which means to undermine the company's reputation which results in the omission or reduction of dividend payments to investors. Corporates must therefore carefully consider both the direct and indirect influences on dividend decisions related to ESG policies and how ESG success affects them. The firm's reputation could be harmed by the critical approach to the disclosure of the sustainability practices. Corporates must therefore consider both the direct issues that determine dividend decisions connected with ESG standards and the indirect factors that affect those decisions. The firm's reputation could be harmed by the critical approach on the disclosure of the sustainability practices. Therefore, it is crucial for management to understand how ESG disclosure impacts a company's performance and reputation. The study seeks to understand the connections between ESG performances and corporate dividend policies through the communicated role of company reputation in light of the aforementioned factors as well as the influence of ESG orientation and performance on return to fulfil shareholders' expectations.

A transparent, high-standard ESG disclosure by the top management is essential since a better demonstration of the company's sustainability objectives will enhance value creation by offering the appropriate return. Focussing on the moderating impact of corporate governance on the dividend policy as studied by (Chae et al., 2009; Olud, 2020), impends the importance of strategies, ethical elements of leaders, CEO qualities, etc. Therefore, motivated through the literature, the current study aims to understand the moderating impact of CEO efficiency on the ESG-dividend payout linkages as suggested by (Versimo & Lacerds, 2015) on the mechanism that links the leader's integrity, including the CEO efficiency, with the company's ESG disclosure. The study is novel as it provides the evidence on the direct and indirect role of company reputation and CEO efficiency respectively on the ESG practices – dividend decisions linkages focussing on the Indian market where the literatures are scant. The paper is structured as follows: Section 1 describes the introduction following the context and theoretical framework in Section 2. Section 3 presents the literature review and hypothesis development. Section 4 demonstrates the conceptual framework followed by elaborating the research methodology in Section 5. Section 6 describes the results. Section 7 presents the robustness of the study, and Section 8 has concluded the study.

THE CONTEXT AND THEORETICAL FRAMEWORK

The decision to overinvest is driven by management discretion and free cash flow scenarios. This situation is more critical with limited growth opportunities. Singla and Samanta (2018) indicated that dividend distributions reduce the free cash flow which affects the agency problem. The market has observed a negative reaction to dividend omission and a positive reaction to dividend announcements (Ali, 2022). In light of this, management may increase dividend payments to reduce the agency's operational financial issues (Agarwal & Chakraverty, 2021). Furthermore, the payment of dividends could result in a high cost of debt, which would make it difficult for management and directors to agree on how to distribute profits to shareholders. They may decide on a flexible dividend strategy to stay away from underinvestment and high-interest rates on debt. This assumption, however, is called into question by the pressures of ESG practices as more money and capital are needed for sustainable growth and long-term gains concentrating on the social and environmental goals in India. The study gathers the understanding of the relevant associated theories in order to comprehend the ESG practices-dividend decisions linkages. They are Agency Theory, Stakeholder Theory, and Signalling Theory.

Agency Theory

Asymmetrical information presents problems for both insider and outsider stakeholders, according to agency theory. Stakeholders favour dividends over retained earnings as a result. Over time, the solutions to agency problems have evolved to include board independence, debt utilisation, and stringent management. Dividends and the disclosure of both financial and non-financial information are proposed as remedies to the agency dilemma (Lloyd & Page, 1985). Reinvesting profits back into the company rather than paying dividends to shareholders can harm the reputation of the company and only benefit the managers. Therefore, dividend distribution is the organisation's solution for minimising agency problems. More crucially, the non-financial disclosure encourages investors to have faith in the company's reputation. These might produce the low-debt external financing that companies could use to pay dividends. The positive correlations between ESG practices and dividend payouts, therefore, suggest a decrease in agency problems, knowledge asymmetries, and transparency policy.

Stakeholder Theory

Shareholders and stakeholders are the most important parts of any organisation, ESG practices and their high score can meet their expectations. High dividend payment ties to ESG practices show the business's commitment to stakeholders (Benlemlih, 2019). The company can set aside short-term cash flows for dividend payments in order to reinvest profits back into the business, improving ESG performance. In summary, the core idea is how sustainable business practices affect dividend payments and ultimately benefit all stakeholders. However, dividend decisions have contradictory implications in terms of threats, motivations, and benefits for the development of business (Bhattacharyya, 2007). Considering these viewpoints, the current study asserts that ESG practices of the business foster stakeholders' faith in the reputation of the organisation and, as a result, lessen information asymmetry.

Signalling Theory

This theory posits the line of communication that exists between market participants. It also refers to the exchange of signals between participants in the financial market. The management's open communication with stakeholders regarding business-related non-financial issues lowers the expenses associated with information asymmetry and financing while also improving the company's reputation. The management's disclosure of the sustainability report indicates how well-informed stakeholders are, which improves their support for the businesses. Reporting on sustainability is therefore a tool for evaluating managerial behaviour.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

The extent of the literature has made on the ESG disclosure and the dividend payout decisions which is affected by the several factors who vary across the emerging markets. Through reviewing the national and international literatures, the study extracted the key variables and has developed the hypothesis.

ESG Practices and Corporate Dividend Decision

Non-financial disclosures can have an impact on the firm's dividend policy in addition to financial indicators (Zahid,

2022; Johansson & Fahlen, 2019). The earning and debt cost channels are the two different routes of nonfinancial disclosures for corporate dividend decisions. According to the earning approach, disclosing non-financial information enhances a company's reputation, which tends to lessen information asymmetry between internal and external investors. Consideration of the non-financial disclosure strategy that builds business reputation improves access to capital from investors and encourages managers to increase dividend payments by lowering the cost of financing. (Zahid, 2022) evidenced the negative relationship between dividends and the cost of debt binds the fewer constraints for the company's results in paying higher dividends. The nonfinancial disclosure by the companies provided possible information about ESG to the investors (Ghoul et al., 2011). And thus, as a result, due to the reduced information asymmetry, the high integrity, transparency and decreasing transaction costs benefit the dividend distributions. The ESG disclosure of the organisation signals the financial market information that the company can control social and environmental risks. Reporting ESG aspects builds strong corporate governance and a good company reputation in the eye of the investors. ESG reporting's perceived risks are lower, which decreases the risk premium and encourages companies to pay out higher dividends. The latter, a learning channel, has a favourable relationship with dividend payments (Mitton, 2004). It serves as an example of how non-financial disclosure conveys the company's dedication to its stakeholders, which is the primary factor in profitability. The company's ESG policies are valued by investors, which leads to a number of benefits including increased employee productivity and strengthening brand equity. By offering the proper return in the form of dividends, these features help stakeholders protect their interests.

Previous research on sustainable practices demonstrated the positive relationship between dividend policy and CSR (Pham & Tran, 2020; Mitton, 2004; Wang et al., 2022). According to Wang et al. (2022), companies with higher ESG rankings pay larger dividends. They discovered that a company's non-financial disclosures reduce the perceived risks of investors, which strengthens stakeholder relationships with the companies and increases investment efficiency (Wang et al., 2022). More so, as shown by (Zahid, 2022) who asserts that dividends and sustainability practices develop simultaneously, indicating that ESG policies do not harm shareholders' expectations for dividends. However, several authors (Niccolo et al., 2020; Ni & Hang, 2019) noted a conflict between the dividend policy and ESG principles. They claim that because of the negative correlation between them, firms may reinvest

profits which have been generated through reducing loan costs. Contradictory parts of their relationship show that in the long run, the profit that has increased as a result of ESG practices needs financial rewards. As a result, investors with longer time horizons favour companies that generate high ESG scores, and vice versa. Therefore, the proposed hypothesis is,

H₁: The ESG practices positively affect corporate dividend decisions.

Intervening Role of Firm Reputation on the ESG-Corporate Dividend Decisions

Zahid (2022) evidenced that a company's involvement in ESG practices would enhance the firm's governance system as well as its reputation. An organisation with a good reputation can raise funds from an external source with less debt, which helps the business keep the external funds for dividend payments. The notion that investors connect an organisation's nonfinancial disclosure with good corporate governance and a positive reputation (Syed, 2018; Pharm & Tran, 2020), therefore, this positive aspect reflects the favourable associations between ESG practices and dividend payment.

However, a company's corporate reputation represents its quality, which stakeholders evaluate by contrasting its actions with those of other companies. According to Pradhan (2016), a company's reputation is how people perceive it, including how well-known or unknown it is. According to the current research, which takes into consideration the many different points of view, the firm's reputation is represented by its enterprise value, which includes its market capitalisation and cash position.

Lai et al. (2010), reported partial mediation between CSR, brand performance, and corporate reputation. Pradhan (2016) evidenced the enhanced firms' performance through the transmitting effects of the firm's reputation. Additionally, according to (Pham & Tran, 2020; Zahid, 2022; Masmoudi & Barhoumi, 2023) research, showing off the company's social behaviour may increase the public's faith in its shareholders, which might help the company's reputation. This study is inspired to investigate the idea of firm reputation as an intervening factor in ESG practices and dividend decisions by the literature concentrating on firm reputation. As a result, the current study assumes the favourable impact of corporate reputation on the ESG-dividend decision relations while focussing on the diverse viewpoints of the literature. Hence, the proposed hypothesis is,

H₂: Firm reputation positively mediates the ESG practices – corporate dividend decision relationship.

ESG Performance - Corporate Dividend Decisions Linkages and the Moderating Role of CEO Efficiency

According to research, management must design its strategy around decisions regarding the appropriate dividend distribution and shareholder retention because the organisation's primary goal is to maximise shareholder wealth (Vihan, 2020). The instances in which managers distribute dividends to shareholders for the benefit of the company attracts the attention of academics as well. The personal key characteristics of the CEO, who is responsible for developing the corporate strategy and may alter the strategic choices made by the company with a focus on dividend policy, are not included in these viewpoints. Despite all of these measures and in an effort to reduce the agency issue, determining the dividend payout results in a showcase of the managers' efficiency (Elyasiani, 2015). Indeed, the research on dividend distribution demonstrated the CEO's crucial role and its power in developing markets like India (Pradhan, 2016). In essence, researchers suggest that a manager's efficiency and degree of confidence have a significant impact on dividend payment decisions, which tend to improve the success of the company. When focused on environmental disclosure, Brockman and Unlu (2011) analysed the agency cost version of the dividend policy lifecycle and found the transparent disclosure results in larger dividend payments. As a result, the management observed that a leader's ethical behaviour improves the company's brand, which encourages investors to place their confidence in the company. Trevio et al. (2000) added that the moral responsibility of the leader is in the same line. Additionally, ethical leaders influence the strategic choices made by the company, such as the dividend payout, which demonstrates their effectiveness, in addition to leading the organisation for ethical ideals. Additionally, the CEO's high efficiency reflects better managerial company judgements. This step results in the business's ESG features being taken into consideration. The firm's involvement in ESG issues would increase investor confidence.

As a result, their work lays out the theoretical framework for considering the potential effects of CEO efficiency on ESG performance, dividend payments, and links with firm reputation. Additionally, a CEO with greater efficiency would improve a company's performance, which would increase the public's faith in the company. This move has the effect of improving the companies' reputation by increasing their positive public image. A firm's reputation is generally impacted by ESG practices when management efficiency is higher. Therefore, the proposed hypothesis is,

H₃: Manager's efficiency positively moderates the relationship between ESG practices- firm reputation.

CONCEPTUAL MODEL

The study aims to examine the indirect and direct roles of firm reputation and CEO efficiency, respectively, in order to investigate the relationships between the ESG practices and corporate dividend decisions of the Indian listed companies.

Apart from these, the selected control variables have also been used which have its potential impact on the linkages which have been discussed further. Fig. 1 proposes a conceptual framework to illustrate the explored relations in the study.

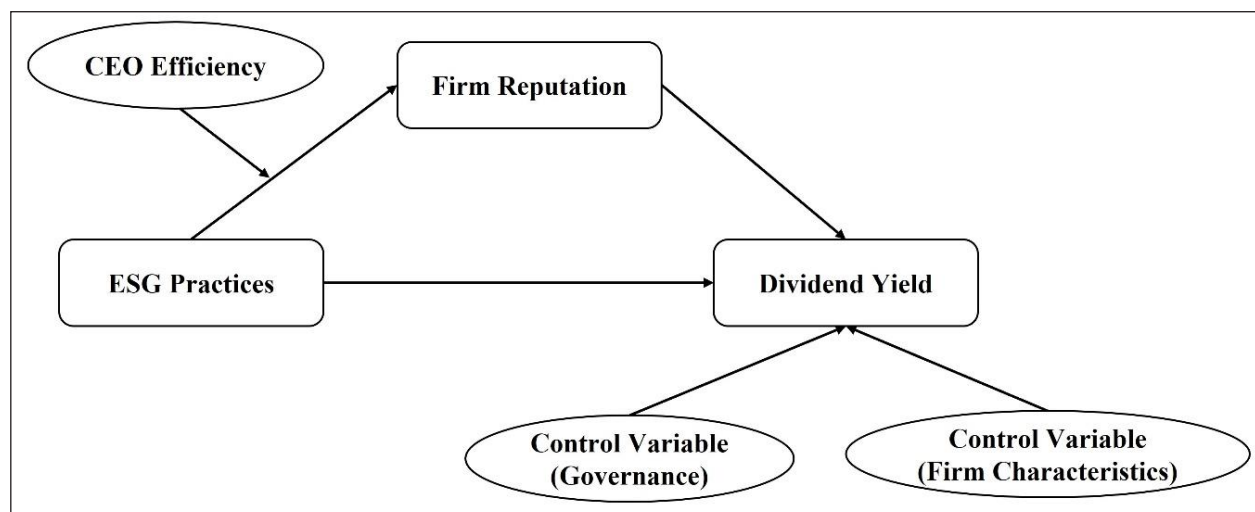


Fig. 1: Conceptual Model

RESEARCH METHODOLOGY

Research Design

The present study aims to examine the ESG-dividend decision linkages transmitted through corporate reputation while incorporating the moderating role of CEO efficiency on the Indian listed companies. The study is motivated by the literature made on ESG practices and its reporting by corporations across the globe and also takes into account its popularity. As a result, the study identifies Indian listed companies on the National Stock Exchange (NSE) 500 Nifty index that consistently disclose ESG information using data obtained from Bloomberg and Prowess IQ for the years 2013 to 2022. After eliminating the missing data from each of the variables that has been chosen, 98 companies are taken as samples from the study's overall dataset. The topic of multicollinearity among the independent variables has been examined in the study. The endogeneity problems have also been evaluated using a variety of tools. Regression techniques have been used including the Hausman test for the baseline model, the 2SLS IV (instrument variable) regression method and the SEM technique to determine the mediation effect of the firm reputation on the ESG - dividend payment linkages of the study.

Variables Descriptions

Dependent Variable

The present study has used the dividend yield to measure the dividend decision of the firms. The dividend yield (Chae, 2009; Kim, 2020) is representing the consistent measures of the corporate dividend.

Independent and Moderating variable

The yearly aggregated ESG disclosure is the main independent variable of the study. As suggested in the prior literature (Zahid et al., 2022; Pham & Tran, 2020) that the ESG disclosure score ranges from the scale of 0 to 100 determined based on the corporates' financial and nonfinancial indicators considered as a proxy variable to represent the main independent variables of the study to know it's the effect on the dividend decisions.

In particular, the literature on CEO efficiency in developing markets like India is less developed. The purpose of this research is to measure the moderating impact of CEO efficiency in order to understand the relationships between ESG practices and the dividend decision policy of Indian companies. This is done in light of the need for the

development of such practices in the emerging market and inspiration from prior literature (Eisenbeiss et al., 2015; Pharm & Tram, 2020) that used CEO integrity, including CEO efficiency as a proxy a variable as the core role as a moderator. The majority of the literature has employed surveys of employee perceptions of CEOs to gauge CEO integrity, the authors note while examining the literature. In addition to these, the studies undertaken also looked at the impact of CEO power (Sheikh, 2022) and CEO traits (Wood & Vilkinas, 2005; Chu et al., 2022) on dividend policy. However, these methods have a few drawbacks, such as the provided information is objective because it was dependent on the CEO's personality as well as the employee's perspective. More specifically, it emphasises on cross-sectional statistics while ignoring longitudinal components like the CEO's change, awareness, and attitude. The present study has used CEO efficiency as a moderating variable, which is proxied by the sales-to-asset ratio and sales-to-expenditure ratio, which are calculated by taking into account the reported accounting financial data of the firms, in order to capture the ethical leadership focussing on his efficiency impact on the dividend payout policy and to overcome the shortcomings of the prior literature. It is calculated as management efficiency is correlated with both the manager's capability and internal governance structure. $CEO\ efficiency = (Sales\ to\ asset\ ratio / board\ independence)$ and $(Sales\ to\ expenditure\ ratio/board\ independence)$.

Selected proxy variables' calculations are consistent with (Pham & Tran, 2020). Since the current study is only focused on one country (India), it makes the assumption that the firm reporting elements comply with local regulations. As a result, the reporting standard of auditing is not taken into account when calculating CEO efficiency.

Mediator Variable

The mediating relationship between ESG and dividend decisions has been examined using firm's reputation (Sayed et al., 2018; Pharm & Tram, 2020; Pradhan, 2016). Enterprise value has been used as a proxy variable to gauge the firm's repute which is calculated as $(market\ capitalisation + total\ debt - cash\ equivalent)$.

Control Variables

Following the recent literature and empirical studies made on the determinants of the dividend policy, the study identifies the number of control variables that may have a potential impact on the dividend payout policy of the firms. The identified firm and corporate governance characteristics of the firms that isolate the ESG practice's impact on the dividend payout policy are as under:

Firm Characteristics

Firm performance (proxied by return on assets ratio), firm size (logarithm of total assets), free cash flows (logarithm of free cash flows), leverage (proxied by total debt to equity ratio), profitability, and free cash flows are the main determinants of the dividend policy of the firm who are having the positive correlations with the dividend payout policy (Boshnak, 2021; Amahalu et al., 2017; Shah, 2020; Mehndi et al., 2017).

Corporate Governance Characteristics

The three recognised control variables of corporate governance that influence the company's dividend payment policy are board size (the number of board members), board independence (the percentage of independent directors), and CEO duality (the CEO's dual position measures "1" otherwise "0"). (Mehdi et al., 2017; Najjar & Kilincarlan, 2016; Boshnak, 2021).

Dummy Variable

Crisis Period

The study period spans the Pandemic-related crises, which has an impact on the company's financial standing and reputation. As a result, the crisis period (i.e., 2020 and 2021 as it reached its peak) has been utilised as a dummy variable in the analysis to account for any potential effects it may have on ESG practices and dividend payment choices. It indicates "1" for the crisis time and "0" otherwise to reflect the same to gauge how it affects dividend payment.

Empirical Models

To test H₁, the following is the model estimation whereby, the dividend yield and dividend to sales ratio are used respectively as the dependent variables and the ESG practices have been used as a predictor. The model includes the control variables to evaluate its potential effects on dividend payout policy.

$$\text{Dividend yield} = \alpha + \beta_1 \text{ESG} + \beta_2 \text{firm size} + \beta_3 \text{free cash flows} + \beta_4 \text{leverage} + \beta_5 \text{profit} + \beta_6 \text{board size} + \beta_7 \text{board independence} + \beta_8 \text{CEO duality} + \beta_9 \text{crisis} + e \quad \text{-----} \\ \text{---- (1)}$$

Following Pharm and Tram (2020), the study has developed models (2) and (3) applying the structural equation modelling techniques. In model (2) the ESG practices are the predictors whereas company reputation is the dependent variable. In model (3) company reputation is the predictor whereas

dividend yield is the dependent variable alternatively. Few control variables are used to evaluate its potential impact on a firm’s dividend policy.

$$\text{Company Reputation} = \alpha + \beta_1\text{ESG} + \beta_2 \text{ firm size} + \beta_3 \text{ free cash flows} + \beta_4 \text{ leverage} + \beta_5 \text{ profit} + e \text{ ----- (2)}$$

$$\text{Dividend Yield} = \alpha + \beta_1 \text{ company reputation} + \beta_2 \text{ firm size} + \beta_3 \text{ free cash flows} + \beta_4 \text{ leverage} + \beta_5 \text{ profit} + \beta_6 \text{ board size} + \beta_7 \text{ board independence} + \beta_8 \text{ CEO duality} + \beta_9 \text{ crisis} + e \text{ ---- (3)}$$

For testing hypothesis (3), and evaluating the moderating impact, the study has applied the interaction variable which is the product of CEO efficiency with the ESG practices on company reputation. The equation covers the ESG practices, CEO efficiency and intersection variables are the predictors and also the control variables to capture its impact on the firm reputation.

$$\text{Company Reputation} = \alpha + \beta_1 \text{ ESG practices} + \beta_2 \text{ CEO integrity} + \beta_3 \text{ ESG*CEO integrity} + \beta_4 \text{ free cash flows} + \beta_5 \text{ leverage} + \beta_6 \text{ profit} + \beta_7 \text{ firm size} + \beta_8 \text{ board size} + \beta_9 \text{ board independence} + \beta_{10} \text{ CEO duality} + \beta_{11} \text{ crisis} + e \text{ ----- (4)}$$

EMPIRICAL RESULTS AND DISCUSSIONS

This section discusses the results of the estimated equations.

Descriptive Statistics and Correlation Matrix

The overall descriptive statistics for the variables provided are shown in Table 1. The dividend yield and dividend to sales has an overall mean and standard deviation of 1.4572, -4.6116 and 1.72449, 7.03943 respectively. The ESG’s high-level means (37.8156) with a standard deviation of (11.91690) reflects its consistent role in corporate dividend policy. The mean average of the companies’ total assets is 11.0935. Furthermore, the mean average for profitability, leverage, and free cashflows is 9.5135, 20.6139, and 5.0446 respectively, reflecting their consistency in supporting the stable dividend policy.

Table 1: Descriptive Statistics

	Mean	Std. Deviation
Dividend Yield (percentage)	1.4572	1.72449
ESG Disclosure (score)	37.8156	11.91690
Enterprise Value (in INR)	4.2941	.84641
Free Cash Flows (ratio)	5.0446	10.47909
Firm Size (in INR)	11.0935	1.20049
Profitability (in INR)	9.5135	7.87159
Leverage (ratio)	20.6139	20.28001
Board Independence (in %)	5.8539	1.85376
CEO Duality	.8227	.47333
Crisis (time period)	.2000	.40014
CEO Efficiency 1	.1646	.15013
CEO Efficiency 2	.1761	.10003
ΔESG	2.2372	19.87361
Dividend to Sales (ratio)	-4.6116	7.03943

Source: Calculated by authors.

The correlations between the dependent and independent variables are shown in Table 2. The outcome indicates a positive correlation of dividend yield with the ESG disclosure, firm size, corporate reputation, leverage, profitability, CEO duality and crisis period. It shows

the negative correlations of dividend yield with board independence and ΔESG. Moreover, the dividend yield and CEO efficiency 1 and 2 are positively correlated. Moreover, the negative correlations of dividend yield and dividend to sales is representing the market volatility effects.

Table 2: Correlations of the Variables

	DY	ESG	ΔESG	EV	FCF	FS	LV	PR	BI	BS	CRISIS	CEOD	CEOINT1	CEOINT2
DY	1.000000													
ESG	0.181485	1.000000												
ΔESG	-0.027146	0.348845	1.000000											
EV	0.148841	0.542763	0.171250	1.000000										
FCF	0.047009	0.084250	0.004037	0.078266	1.000000									
FS	0.334561	0.496245	0.119541	0.764165	-0.230302	1.000000								
LV	0.103822	-0.053120	-0.004988	0.146230	-0.515024	0.461206	1.000000							
PR	-0.016581	0.003004	-0.049839	0.110301	0.690609	-0.357439	-0.573138	1.000000						
BI	-0.232198	-0.127114	-0.140814	-0.083193	-0.037836	-0.097176	0.036318	-0.003252	1.000000					
BS	0.135027	0.315267	0.114035	0.370893	-0.002633	0.364300	-0.015624	-0.006565	-0.159679	1.000000				
CRISIS	0.098203	0.243248	0.078474	0.132762	-0.029121	0.104155	-0.001927	-0.040927	-0.104393	0.083938	1.000000			
CEOD	0.135191	0.165964	0.073724	0.107742	0.042879	0.099834	-0.050613	0.021791	-0.072378	0.068413	0.081312	1.000000		
CEOINT1	0.066874	0.069384	0.047979	-0.091084	0.238449	-0.228800	-0.266351	0.298515	-0.405448	-0.024260	-0.017825	-0.040875	1.000000	
CEOINT2	0.169882	0.205808	0.101285	-0.019445	0.164042	-0.104837	-0.397168	0.238602	-0.613092	0.144899	0.073195	0.038617	0.462198	1.000000

Source: Calculated by authors.

Strategy Estimation

The highest values of the variance inflation factor (VIF) for each model are shown in the respective tables. The study uses this measure to evaluate the multicollinearity among the explanatory variables. The highest VIF for each variable has been found lower than the threshold value of 10. The results of the study have not evidenced the multicollinearity problem with the dataset.

The study then evaluated the major predictor's possible endogeneity (i.e., ESG disclosure). When a variable and an error term are correlated, the variable is endogenous (Pharm & Tran, 2020). The pooled OLS model with dividend yield as the dependent variable has been used to get the necessary residual R1. No strong associations between the residuals and the dependent variable were found in the study ($P > 0.05$). The study uses the Wald test and F statistics of endogeneity for the ESG disclosure to evaluate the loop causality between the dependent and independent variables. Large ($P > 0.05$) values suggest that the base equation has not serious endogeneity problem.

To estimate equation (1) using dividend yield as the dependent variable, the Hausman test has been performed. An appropriate suitable model (i.e., fixed or random effect) for analysis purposes has been selected through the P – Values. Obtained results of the Hausman test for the selection of the appropriate model has mentioned in Table 3. To know the indirect effect of firm reputation, the study has framed the SEM equations (2) and (3). To assess the robust impacts, bootstraps with 1000 replications at a 95% confidence level have been run (Pharm & Tran, 2020). Table 4 displays the outcome.

Further, to examine the moderating impact of CEO efficiency on company reputation, equation (4) has been developed. To assess the loop causality between the dependent and independent variables, the study conducts the Wald test and F statistics of endogeneity of the ESG disclosure. ($P < 0.05$) indicates the endogeneity issue between the dependent (company reputation) and independent variable (ESG disclosure). The study has therefore employed the instrument variable Two-stage least square regression method to fix the endogeneity problem. (Pham & Tram, 2020) Δ ESG has been employed as the instrument variable to measure ESG practices (Zahid, 2022). Next, the study has also run the Wald test and F statistics to measure the endogeneity issues with the instrument variables. The ($P > 0.05$) shows no endogeneity issue with the instrument variable. The result is presented in Table 5.

ESG Practices and Corporate Dividend Decisions

Table 3 demonstrates the outcome of equation 1 which depicts the impact of ESG practices on the dividend yield of Indian firms. The result shows that the adjusted R^2 of model 1, which measures the fitness of the model is 61% which is relatively good. Results of the model 1 reflect the positive and significant influence of ESG practices on the dividend yield. Accordingly, the study accepts hypothesis 1. More so, the results report the negative significant impact of board size on dividend yield. It also reflects the positive and significant impact of the crisis period on dividend yield. It also indicates the negative impact of free cash flows on dividends which reflects the serious agency issue.

Table 3: Influence of ESG Practices on Dividend Policy
(Baseline regression results)
Dependent Variable: Dividend Yield

Variables	Co-Efficient	T-Statistics	P-Value
ESG Disclosure	0.020046	2.798460	0.0052
Free cash flows	-0.373424	-0.670758	0.5026
Firm size	0.093907	0.251610	0.8014
Leverage	0.004473	0.725883	0.4681
Profit	0.008660	0.719945	0.4718
Board independence	0.008709	1.512758	0.1307
Board size	-0.040081	-2.045845	0.0411
CEO duality	0.033996	0.236257	0.8133
Crisis	0.330386	3.185119	0.0015
Constant	-0.058898	-0.058898	0.9530
Adjusted R-squared	0.609477		
Prob(F-statistic)	0.000000		
Hausman Test	0.0000		
Max. VIF	2.249		

Source: Calculated by authors

The positive effect of ESG practices on dividend decisions demonstrates that shareholders' expectations of dividend returns are not negated by Indian companies' adoption of ESG practices. Thus, it is evident that dividend payments are a top priority for Indian companies. They help in decreasing agency conflicts while lowering information asymmetry and sending a positive message to the financial market. The study's results are supported by (Zahid, 2022; Wang et al., 2022). Continuing the ability of the ESG practices in boosting the dividend generating through the firm's profitability ($P > 0.05$), the present study shows an

insignificant impact on dividend yield with the profitability. It supports the argument that the firm may reinvest the profit for further expansion (Boshnak, 2021; Mehndi et al., 2017; Shah et al. 2024). Additionally, it also supports the critical approach who describes the opportunistic behaviour of the management who may utilise the profit for their own benefit. With the exception of the enterprises choosing to adopt ESG practices, the model's results show no variations in dividend values over time. The results imply that Indian firms may use their profits towards ESG initiatives rather than dividend payments. Contrary to the outcome, it also demonstrates that Indian companies' dividends are increased by disclosing their ESG practices. The study's findings lend credence to the claim that Indian corporations report ESG policies, which are extremely admirable despite their voluntary disclosure. Additionally, it can make the regulatory body more concerned about the disclosure issues while demotivating shareholders to support companies' ESG projects. Even more so, the observation that free cash flows have a negative impact on dividend yields suggests that Indian company managers act opportunistically by using profits for their personal gain rather than paying dividends to shareholders. The study indicates that firm size has an insignificant effect on dividend yield and concludes that firm size has no impact on payout decisions (Boshnak, 2021; Shah & Paliwal, 2022). It implies that the company can decide how to distribute dividends regardless of its size. As a result of their investment in ESG practices, large-size companies typically distribute lesser dividends. Due to low monitoring costs and the effect of information asymmetry,

which tends to lessen agency difficulties, small companies may distribute greater dividends. Furthermore, leverage has little to no effect on dividend yield. The study's findings are in line with the Indian corporations' priorities of retaining dividends regardless of debt levels.

The present study implies that individual components of corporate governance practices reflect the mixed results of the study. While observing the P-values, the study reports no significant impact of board independence and CEO duality on the dividend yield. The only component of the governance structure (i.e., board size) implies a negative and significant effect on dividend yield. Supporting the current study results, (Boshnak, 2021) reported that due to coordination issues larger board sizes tend to pay lower dividends and vice versa. More so, the insignificant effect of board independence suggests that the involvement of outside directors apprehends the quality of internal monitoring which tends to improve the governance structure of the business (Mehdi et al., 2017; Boshnak, 2021). Moreover, the dual role of CEO and chairman is an ineffective tool to reduce expropriation risk in the Indian markets and less effective for board control. Contradictory to the result, the study does not support the argument that duality affects poor financial performance and in turn lower dividend payments. While observing the crisis period ($P < 0.05$) effect, the study implies the positive and significant impact of the crisis period on dividend yield. The results evidence that the crisis period affects the financial position of the business and in a way affects the dividend decisions.

Intervening Role of Firm Reputation on ESG - Dividend's Relationship

Table 4: Mediating Role of Firm Reputation in the ESG Disclosure - Corporate Dividend Decision Relation

Variables	Estimates	CI 95%		P-Value
		Lower Bound	Upper Bound	
Direct Effects				
Dividends <--- ESG disclosure	.029	.015	.048	0.013
Indirect Effects				
Firm reputation <--- ESG disclosure	--	.028	.077	.003
Dividends <--- Firm reputation	--	.070	.928	.025
Control Variables				
Free cash flows	1.000	.000	.000	...
Firm size	-3.513	-4.344	-2.773	.003
Leverage	-163.514	-190.684	-136.348	.004
Profit	84.356	77.962	90.466	.003
Board independence	-1.226	-8.785	6.665	.812
Board size	-1.403	-4.290	1.716	.409
Dummy Variables				
CEO duality	.130	-.147	.453	.288
Crisis	-.215	-.548	.150	.266

Source: Calculated by authors.

The results of equations (2) and (3) obtained from the SEM bootstraps are presented in Table 4. Bootstraps offer an empirical approximation to the sample approximation for the indirect effects in order to obtain the confidence interval of estimates. Model 3 displays the solutions to equations (2) and (3), where dividend yield is used as the dividend representatives. The firm’s reputation is used to evaluate the links between ESG and dividends. Table 5 demonstrates the significance and insignificant status of the direct and indirect effects. The results observe the significant relationship between ESG practices on dividend yield ($P < 0.05$). The table then extracts the results when firm reputations intervene between the dividend and the ESG relationship. It reports the significant impact of ESG practices on firm reputation ($P < 0.05$; equation 2) along with the significant impact on dividend yield ($P < 0.05$; equation 3). After that to check the robustness of the results the study has run bootstraps with 1000 replications at 95% confidence (Pham & Tram, 2020). The result observes the bootstrap’s upper bound and lower bound values along with the two-tailed significance level reflecting that zero does not fall within the limit which verifies the significant impact of the firm reputation on the ESG disclosure and dividends decision.

Accordingly, the outcome concludes that the ESG-dividend decision relationship is mediated through firm reputation. Hence, the outcome of the study accepts the developed hypothesis 2 which reports that the ESG practices and

dividend decision relationship is mediated through firm reputation. The result is supported by (Pham & Tram, 2020; Pradhan, 2016). The significant impact indicates that ESG practices affect dividend decisions which are transmitted through the company’s reputation. A similar number of studies identify the direct relationship which is inconclusive. The study’s findings are consistent with Pham and Tram (2020); Pradhan (2016) who look at the indirect effects of a company’s reputation with an emphasis on CSR and business performance. Since ESG practices are optional in India, the study’s findings confirm that ESG practices, which are spread through a company’s reputation, have an impact on the choice to declare a dividend by an Indian listed company.

ESG-Dividend Nexus: Moderation of CEO Efficiency through Intervening Role of Firm Reputation (2SLS IV Regression Results)

Table 5 shows the moderating effect of CEO efficiency using the 2SLS IV regression technique. The findings show that the company’s reputation is positively and significantly impacted by CEO Efficiency 1 (as measured by the sales to asset ratio) and CEO Efficiency 2 (as measured by the sales to expenditure ratio). As a result, hypothesis (3), which shows that the company’s reputation is enhanced by the CEO’s increased efficiency, is accepted.

Table 5: Moderating Role of CEO Efficiency

Variables	Model 5 (CEO INT 1)			Model 6 (CEO INT 2)		
	Co-Efficient	T-Statistics	P-Value	Co-Efficient	T-Statistics	P-Value
ESG disclosure	0.023464	4.256335	0.0000	0.039490	3.639177	0.0003
CEO Efficiency 1	10.97176	2.755889	0.0060	-	-	-
CEO efficiency 1*ESG disclosure	-0.318879	-3.047381	0.0024	-	-	-
CEO efficiency 2	-	-	-	30.03428	2.462437	0.0140
CEO efficiency 2* ESG disclosure	-	-	-	-1.014471	-2.992069	0.0028
Free cash flows	-0.321354	-2.248719	0.0248	-0.447425	-3.018940	0.0026
Firm size	0.696546	19.53566	0.0000	0.743031	28.27647	0.0000
Leverage	0.001370	1.494601	0.1353	0.000535	0.516176	0.6058
Profit	0.034169	16.82697	0.0000	0.035959	17.84099	0.0000
Board independence	0.000267	0.211570	0.8325	-0.004945	-2.984505	0.0029
Board size	0.000714	0.184887	0.8534	0.002150	0.559966	0.5756
CEO duality	-0.022231	-0.764434	0.4448	-0.020454	-0.703601	0.4819
Crisis	-0.000878	-0.027394	0.9782	0.008415	0.271714	0.7859
Constant	-4.510443	-15.92191	0.0000	-5.223926	-15.54285	0.0000
Adjusted R-squared	0.727024	-	-	-	0.723015	-
Prob(F-statistic)	0.000000	-	-	-	0.000000	-
Max. VIF	7.757	-	-	5.590	-	-

Source: Calculated by authors.

Furthermore, the study's findings highlight the critical role of the CEO's efficiency as a moderator as ESG practices are used to boost a company's reputation. The findings of the study are consistent with (Abernathy et al., 2017), who discussed the relationship between ESG disclosure and company performance in their literature review study. With improved managerial efficiency, the company may be able to perform effectively, which in turn results in a dividend distribution that meets the expectations of the shareholders. This is indicated by the positive and significant influence of CEO integrity1 and CEO integrity2 on the firm's reputation. The study makes use of the interacting variables to better comprehend the effects of outliers (the product of CEO integrity and ESG). The conclusions are also supported by the intersecting variables' positive and significant influence. The study's findings are consistent with the claim that corporate reputation plays an intermediary role in how much risk assessments and governance standards influence dividend

decisions (Zahid, 2022; Mukherjee, 2024). Furthermore, it supports the claim that non-financial disclosure has improved investor confidence which in turn has improved the firm's reputation, by demonstrating the positive and significant impact of ESG practices. Additionally, the results show free cash flows, firm size, and profit have a significant impact on the firm reputation for Indian listed companies, which helps to minimise the agency problem through asymmetry of information that spreads good news in the financial market.

ROBUSTNESS OF THE STUDY

Using the lag values for the independent variables, the study evaluates the robustness of the finding (Brockman & Unlu, 2011; Pham & Tran, 2020). The process has utilised the baseline model with the independent variable values for the equation (4) having a one-year lag. Table 6 shows the result, which is almost consistent with the earlier findings.

Table 6: 2SLS Regression Results

Variables	Model 5 (CEO INT 1)			Model 6 (CEO INT 2)		
	Co-Efficient	T- Statistics	P-Value	Co-Efficient	T- Statistics	P-Value
ESG disclosure	0.023196	3.754356	0.0002	0.033120	3.531426	0.0004
CEO efficiency 1	7.609675	2.126772	0.0337	-	-	-
CEO efficiency1 *ESG disclosure	-0.250341	-2.498308	0.0127	-	-	-
CEO efficiency 2	-	-	-	13.48331	1.751126	0.0803
CEO efficiency2 *ESG disclosure	-	-	-	-0.691348	-2.768362	0.0058
Free cash flows	-0.422417	-2.349332	0.0190	-0.576153	-3.200726	0.0014
Firm size	0.683856	15.84327	0.0000	0.715692	20.46110	0.0000
Leverage	0.001302	1.233877	0.2176	-0.000521	-0.520265	0.6030
Profit	0.034995	14.19285	0.0000	0.036972	15.53469	0.0000
Board independence	-0.000106	-0.072473	0.9422	-0.007547	-3.555003	0.0004
Board size	8.29E-06	0.001807	0.9986	0.002922	0.685304	0.4933
CEO duality	-0.032616	-0.980805	0.3270	-0.032845	-1.003444	0.3159
Crisis	-0.035324	-0.881385	0.3784	-0.024280	-0.644133	0.5197
Constant	-4.301320	-12.10231	0.0000	-4.447940	-15.13770	0.0000
Adjusted R-squared	0.686129			0.692718		
Prob (F-Statistic)	0.000000			0.000000		

Source: Calculated by authors.

CONCLUDING REMARKS

The study's objective is to investigate the connections between ESG practices and corporate dividend decisions while evaluating the indirect influence of firm reputation. The dearth of Indian-specific literature serves as the driving force behind the study. The study's findings show a positive and

strong correlation between ESG practices and dividend yield, which is communicated through a company's reputation and tends to increase investor trust. This will contribute to the creation of low-debt investments that firm may use to pay dividends to satisfy the expectations of their shareholders. Therefore, the results of the study provide the channel which is beneficial to ESG practices – dividend decisions.

Furthermore, there can be certain superfluous aspects that have a detrimental effect on the dividend decision when evaluating the advantages of ESG practices with dividend decision. As a result, the study has noted the moderating effect of CEO efficiency on the relationships between ESG practices and dividend policy. The findings show that the CEO's efficiency has a positive and significant impact on ESG practices and the company's reputation. The study's findings show how important the CEO's efficiency is in enhancing the company's reputation as a result of ESG practices.

The study is limited to the proxy variable of the CEO efficiency as it covers the only efficiency aspects which may cause bias. Future research may extend while considering the individual aspects and other variables that can represent CEO integrity while showing the effect of management on the dividend policy.

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WOMEN IN BOARDROOMS AND FIRM PERFORMANCE: A REVIEW OF THE RECENT TRENDS, GLOBAL SCENARIO, AND WAY FORWARD

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Abstract *The aim of this review paper is to explore the literature on board gender diversity (BGD) as a corporate governance strategy and whether it brings a favourable impact on firm's performance. While referring to previous empirical studies, we found a mixed view of the impact of women on boards (WOB) on firm's performance (FP), but the majority of literature does present a business case for having women directors. To establish the quality and objectivity of this review paper, articles from several high-ranked journals which were published between 2001 and 2023 were selected, and a structured investigation was carried out to prepare a clear meta-analytic presentation of the theme. The findings from chosen research have been categorised, synthesised, and summarised to touch upon the role of gender in corporate boardrooms across four major continents and put forward its implications. Through our cross-continent analysis, we discover stronger positive WOB-FP relationships in developed nations (with higher gender parity scores) than in emerging economies. Our research underpinnings suggest scanty research in the African Subcontinent emanating from inadequacies of a conducive and progressive business environment, while still asserting a positive WOB-FP link. Critical mass and resource dependency theories have also influenced a large section of the literature. This study pulls out many important themes from empirical research on board gender diversity that has been undertaken for over two decades now which aids in identifying pitfalls in the global context and establishing a research agenda for the future.*

Keywords: *Corporate Governance, Board Composition, Board Gender Diversity, Women Directors, Firm Performance*

INTRODUCTION

The board of directors' act as an internal governance system by appointing, constituting, supervising, and remunerating senior executives, as well as determining overall business strategy collectively. The Sarbanes-Oxley Act (2002) in the US had set the foundation for boardroom reforms and women on corporate boards has been a sought-after research agenda since then. Since then, a great volume of research has investigated the influence of board composition on a firm's performance and value (Bhagat & Bolton, 2008; Connell & Cramer, 2010; Palaniappan, 2017; Mishra & Kapil, 2018).

In the last two decades, board gender diversity as an aspect of board composition has attracted interest of researchers (Erhardt, 2003; Rose, 2007; Campbell & Minguez-Vera, 2008; Adams & Ferreira, 2009; Carter, 2010; Ahern & Dittmar, 2012; Liu, 2014; Mahadeo, 2012; Sarhan et al., 2018; Sen & Mukherjee, 2019; Brahma et al., 2020;

Duppatti et al., 2020; Mastella et al., 2021; Abbas & Frihatni, 2023, and others) as they intend to look into the impact of board diversity (described as the variability in the board's composition) on firm performance and other firm decisions and outcomes.

Adam and Ferreira's (2009) study is the pathfinder in this research stream where they claim that gender varied boards devote more time to monitoring and that gender diversity has a detrimental impact on business performance on average. However, another set of studies claim that women directors add value and have a beneficial influence on the financial success of the company (Singh, Vinnicombe & Johnson, 2001; Erhardt, Werbel, & Shrader, 2003; Campbell & Minguez-Vera, 2008; Carter, Francoeur, Labelle & Sinclair-Desgagné, 2008; Nguyen & Faff, 2012; Reguera-Alvarado et al., 2017; Green & Homroy, 2018; Đặng et al., 2020; Mohsni et al., 2021) while a third body of research consensus (Carter et al., 2010; Rose, 2007; Chapple & Humphrey, 2014)

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reveals no relation between board of directors diversity and company performance. As a result, the impact of board diversity on business performance remains an open question that needs further investigation.

Many countries are actively implementing or considering a variety of initiatives to improve diversity on corporate boards. As stated by Labelle, Francoeur and Lakhali (2015), there can be three approaches to ensure that women have a seat at the table. The first is coercive and involves enacting affirmative legislation to ensure that a suitable proportion of women are represented on corporate boards through quotas (Norway, Belgium). Enabling is a second strategy in which corporations are compelled by law to comply with given norms or explain why they do not (Spain, Netherlands). The third is a voluntary approach, where companies (driven by market forces) can voluntarily choose to nominate women to their boards of directors or not (UK, Australia). The market pressures and the “soft” or “hard” legal actions are all founded on the belief that the presence of women has a favourable and noteworthy impact on the quality of governance and strategic management in companies and, therefore, their results.

Given the ongoing developments which promote gender equality and women’s rights, this review paper focusses on gender not just in terms of gender diversity on boards, but also in terms of female participation in economic activities and society at large. The argument about fair treatment of men and women in society is likewise relevant to board diversity. In this introductory section, we also attempt to put forward some positive payoffs of having women directors.

Why Women?

A lot of research literature claims to a great extent that gender diversity on company boards enhances firm value and performance because of the inputs and advancements that female directors bring to the board. According to some studies, variety leads to increased knowledge, creativity, and innovation, which becomes a competitive advantage (Opstrup & Villadsen, 2014; Lee & Thong, 2022). The heterogeneity of board expertise and skill set is linked with higher firm value. The variation in functional expertise in a group, which comes from differences in team members’ relevant knowledge and experience, creates a diversified informational resource for the group, which brings out positive group outcomes in the form of higher decision quality and greater creativity (Zhao, 2011; Kim & Stark, 2016).

Such contributions can have a two-fold impact on performance. Diversity is the first channel. More gender

diversity in the workplace is expected to increase corporate performance if diverse teams outperform homogenous teams (Kahane et al., 2013). Female directors help to diversify the human capital on boards, which might lead to better decision-making, better monitoring, and the departure of less productive male directors (Hermalin & Weisbach, 2003). The second channel is based on discrimination reduction. Companies would be at a competitive disadvantage if there is a lack of female participation on corporate boards due to discriminatory gender policies (Becker, 1957; Miller & Triana, 2009).

According to the findings of a meta-analysis, women may lead in a different way than men (Terjesen, Sealy & Singh, 2009; Gipson, Pfaff, Mendelsohn, Catenacci & Burke, 2017; Kirsch, 2018), are more collaborative, and promote participatory decision-making (Mano-Negrin & Sheaffer, 2004; Bart & McQueen, 2013), which leads to lesser board conflicts (Nielsen & Huse, 2010).

Women and Ethics

Female board representation, we contend, has direct and indirect implications on the value of the firm. In addition, we argue that if BGD has an impact on company value, financial performance measurements may or may not capture that impact. Women directors may have an impact on other aspects of the firm, such as qualitative improvements not represented in financial statements.

Jo and Harjoto (2011) and Rodgers et al. (2013) illustrate that a company’s commitment to strong social responsibility standards boosts its worth. Adherence to ethical ideals, according to Donker et al. (2008), has a positive influence on corporate value. Furthermore, having more women in a room has been shown to increase social and ethical involvement. Increased female board participation promotes corporate social responsibility. According to the authors, women’s enhanced knowledge of social concerns contributes to higher corporate social responsibility (Bear et al., 2010; Hafsi & Turgut, 2013). Williams (2003) found that companies with more gender-diverse leadership are much more involved in philanthropy and social responsibility activities and programmes, and stakeholders view such activities as value-creating (Catalyst, 2011).

In view of the above arguments, this review is an attempt to integrate and consolidate the diverse interpretations surrounding WOB & FP. In the subsequent sections, we put forth the theoretical foundations guiding gender diversity, followed by our review methodology, a cross-continent literature analysis, and conclusion.

THEORETICAL PERSPECTIVES

Corporate boards of directors have a unique set of responsibilities where the key goal is increasing shareholders wealth. If a business case can be established for BGD, they may be inclined to embrace and evaluate it. Various boardroom diversity theories have arisen throughout time, all of which suggest a link between board diversity and corporate value, but no single theory can predict how the connection will play out.

The Agency Theory (AT) examines conflicts of interest between principals (e.g., shareholders) and agents (e.g., managers), as well as how the board of directors of a company might monitor and resolve them (Fama & Jensen, 1983; Jensen & Meckling, 1976). Diversity, according to the board's agency viewpoint, improves the monitoring function, which has an influence on company performance (Adams & Ferreira, 2009; Adams et al., 2009).

It was proposed that board diversity had an impact on corporate performance, based on Social Psychology theory (SPT). Croson and Gneezy (2009) and Palvia et al. (2015) proposed that behavioural differences between men and women gave advantages to organisations. In contrast, Amaram (2007) claimed that a diverse board may contribute to dysfunction in cases where there was a battle of views.

Becker's (1964) Human Capital Theory (HCT) analyses persons as capital from an economic standpoint, arguing that an individual's worth or value is determined by their level of skill, education, and experience (Bhagavatula, Elfring, Van Tilburg & Van De Bunt, 2010; Unger, Rauch, Frese & Rosenbusch, 2011; Lee & Lee, 2016). The fundamental argument is that women bring distinct levels of abilities, information, and perspectives to decision-making that males do not have, and thus they offer value.

According to Resource Dependence Theory (RDT), increasing the size and diversity of the board of directors can help enhance the link between businesses and their surroundings (Pfeffer, 1973; Goodstein, 1994). In other words, organisations with bigger and/or more diverse boards may assist to increase the firm's critical resources (Liu et al., 2014). Researchers in this field support the resource dependency theory since directors' diverse backgrounds in terms of gender, expertise, and nationality bring a wide range of experiences and viewpoints to the table, which ultimately enhances the efficacy of the board (Hillman et al., 2003; Vafaei et al., 2015).

"Numbers are necessary," according to Token Status (TST) (Kanter, 1977) and Critical Mass (CMT) Theories (Kristie, 2011), if organisations are to reap the full advantages of

board diversity. When women and ethnic minorities make up a tiny fraction of a board, they are considered "tokens" or "solos," according to the token status hypothesis. The critical mass theory is an extension of the token status theory, positing that "one is a token, two is a presence, and three is a voice" (Kristie, 2011). "The magic seems to happen when three or more women serve on a board together," Kramer et al. (2007) write.

On the other side, the Competency gap theory (CGT) says that women are not given board positions as they lack the essential credentials, skills, and abilities. The 'competency gap' is another factor that contributes to board homogeneity. There is a scarcity of women and ethnic minorities with the necessary skills, abilities, qualities, and expertise for directorships, which leads to their holding of numerous directorships in various firms, which makes them too busy to do justice to their role and position, and it raises the risk of agency issues, which could lower the firm's worth (Jiraporn et al., 2009; Falato, 2014).

Stewardship theory (SWT) views managers as great stewards who work in the best interests of the company, while boards should concentrate on strategic planning and development along with collaborative & mentoring functions (Huse, 2005). In this case, the stewardship theory suggests that women are more effective as directors, in interacting with upper management to improve company performance directly since women are more likely to emerge as transformational leaders with their effective collaborative and networking tactics (Eagly et al., 2003; Low et al., 2015).

Legitimacy Theory (LT) acknowledges women's contribution in the form of increased legitimacy in the eyes of the firm's stakeholders. Within some socially formed system of rules, norms, and values, legitimacy is the common assumption that a practice is desirable, suitable, or acceptable (Suchman, 1995). Theorists say that having a diverse board helps to protect important resources such as board members' human capital, advice and counsel, communication channels, and legitimacy (Pfeffer & Salancik, 2003; Hillman & Dalziel, 2003).

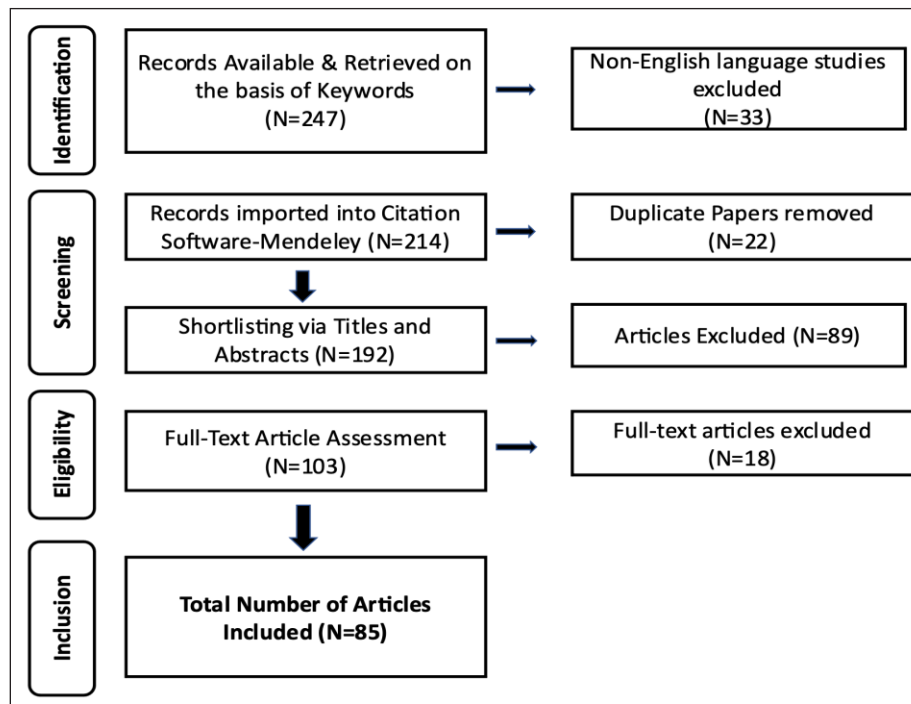
Upper echelons theory (UET) is based on Donald C. Hambrick's (1946) and Phyllis A. Mason's (1984) assertion that "the organisation is a reflection of its top managers". According to the notion of the Upper Echelon, gender composition is a type of non-functional diversity that is beneficial to high-performance management teams (Herman & Smith, 2015) and that diverse executive teams outperform homogeneous ones in terms of innovation (Bantel & Jackson, 1989), strategy (Bantel, 1993), competitive response (Hambrick et al., 1996), and speed of change implementation (Williams et al., 1995).

The Stakeholder theory (SHT) by Fryxell and Lerner (1989) addresses the participation of various minority groups on the company board of directors. Therefore, in addition to the shareholders/owners, the company must also consider the interests of other stakeholders in the company, such as employees, customers, suppliers, finance providers, etc. Gender diversity on corporate boards and in senior leadership roles are critical indicators of a socially responsible, sustainable, and stakeholder-oriented firm (Ibrahim & Angeledis, 1994; Webb, 2004). In addition, it is argued that increasing the number of women on the board provides for a more transparent governance system that ensures the consideration of stakeholder interests (Francoeur et al., 2008).

METHODOLOGY

A literature review article's objective is to give a complete overview of literature relating to a theme, theory, or technique, as well as to synthesise previous works to strengthen the foundation of that body of knowledge (Paul & Criado, 2020). A systematic literature review methodology (as shown in Fig. 1) is applied and the basic guidelines proposed by Tranfield et al. (2003) for conducting systematic reviews in management were adapted and customised into a three-step process. The steps are the following:

- Identify the need and objectives of the review, prepare a research plan, and develop the review strategy.
- Identify the keywords, select studies, quality screening, full text study, extract and synthesise data.
- Report and disseminate the result.



Source: Author's own tabulation.

Fig. 1: Systematic Literature & Database Search

Spotting Relevant Studies

To address our research objective, a structured assessment of the literature was started in 2022 without any timeframe restrictions. Top-ranked indexed journals served as the primary source for retrieving research articles on BGD. The term “board gender diversity” was searched in all articles' titles. Alternatively, “women on board” and “females on board” were also used to locate relevant papers from the

database. To build up on our underlying research stream, we used the snowball effect to generate additional searches using the referenced work of relevant articles. A notable amount of ‘grey literature’ including working papers and unpublished reports was also identified, but these were kept outside the purview of this paper for quality purposes. Finally, to construct a sound theoretical review, relevant papers from high-ranked journals were selected.

Study Selection and Assessment

The eligibility of the selected papers was evaluated based on a predefined criteria. Some papers were excluded in the preliminary stage due to language, subject area, and document type restrictions. The abstracts and introductory sections of the appropriate papers were then assessed. Articles not meeting the required inclusion criteria (based on the variables studied and context) were excluded at this stage. Some other papers were also rejected, given our time frame requirements. Subsequently, a full text review of the chosen articles was carried out, and key elements of the studies were mapped in MS Excel spreadsheets (including doi, journal, context, variables, and findings).

Analysis, Synthesis, and Reporting

After excel mapping, all articles were analysed in emerging themes and contexts, and a country wise grouping was done. A thematic content analysis was carried out based on gender theories applied, variables studied, country of study, and reported findings. Consequently, an effort has been made to present the outcomes of this research in a manner which will aid further research in this area.

Table 1 indicates the list of journals selected along with the number of papers procured from each.

Table 1: Selected Journals and No. of Papers Retrieved

Journal of Publication	Number	Journal of Publication	Number
Corporate Governance: An International Journal of Business in Society	6	Emerging Markets Review	3
Journal of Business Ethics	7	Meditari Accountancy Research	1
Journal of Management Studies	1	International Journal of Productivity and Performance Management	1
Journal of Financial Economics	1	International Journal of Entrepreneurial Behavior & Research	1
Corporate Governance: An International Review	2	Journal of Behavioral and Experimental Finance	1
Journal of Business Research	3	Journal of Family Business Strategy	1
Academy of Management Journal	1	Corporate Governance: the international journal of business in society	1
Strategic Management Journal	1	Gender in Management: An International Journal	1
Gender in Management: An International Journal	1	Management Decision	2
Journal of Empirical Finance	1	Journal of Money and Business	1
Journal of Leadership & Organizational Studies	1	Corporate Governance: The International Journal of Business in Society	1
Journal of Banking and Finance	2	Journal of Financial Reporting and Accounting	1
Economic Modelling	1	Asian Business & Management	1
Gender in Management: An International Journal	2	Pacific Accounting Review	1
Journal of Sustainable Finance	1	Corporate Ownership and Control	1
International Journal of Productivity and Performance Management	1	Journal of Corporate Finance	1
The International Journal of Human Resource Management	1	Pacific-Basin Finance Journal	1
British Journal of Management	1	Australian Accounting Review	1
Journal of Business Finance & Accounting	2	Benchmarking: An International Journal	1
Spanish Accounting Review	1	Applied Economics	1
The Quarterly Journal of Economics	1	Equality, Diversity and Inclusion: An International Journal	2
Journal of Management and Governance	1	International Business Review	1
The Economic Journal	1	Int Advances in Economic Research	1
Public Administration Review	1	Journal of Commerce & Accounting Research	2
European Economic Review	1	International Journal of Accounting & Information Management	1
Research in International Business and Finance	1	Management Research Review	1
International Review of Economics and Finance	2	International Journal of Emerging Markets	2
Cogent Economics & Finance	1	Society and Business Review	1
The Leadership Quarterly	1	International Journal of Managerial Finance	1
International Journal of Finance & Economics	2	Journal of Capital Markets Studies	1
Total Number of Articles			85

Source: Author’s own excel tabulation.

LITERATURE REVIEW

This review paper examines studies of the last two decades. The findings from the previous research have been categorised, synthesised, and summarised, to understand and establish key trends, themes, and emerging areas for future research. To enable a comparative investigation, the literature review comprises of two sections: A Cross-continent analysis and Review of variables and measurements.

Cross-Continent Analysis

To enable a comparative investigation, the literature review has been categorised based on four broad regions: American, Europe & UK, Africa & Middle East, and Asia-Pacific.

American Region

Gender diversity on US boards has a considerable impact on performance (Hafsi & Turgut, 2013). Erhardt, Werbel

and Shrader (2003) evaluated the influence of BGD on the performance of 112 large American listed corporations. They conclude that variety improves group dynamics, which improves decision-making, and the idea was that by having a more diversified board of directors, the organisation's performance would improve. The data supported the idea that a more diverse board of directors leads to better results. Using Tobin's Q (TQ) for firm performance, a similar positive relationship was reported by Francoeur et al. (2008), Dezso and Ross (2012), Canyon and He (2017), Chen et al. (2018), Fernando et al. (2020), and Mastella et al. (2021). Moreno-Gomez (2017) et al. discover a similar link in major Canadian and Columbian corporations, respectively. Wiley and Monllor-Tormos and Owen and Temesvary (2018) bring out robust findings using alternative proxies for gender and performance, where they argue that BGD yields higher company performance only when there is a critical mass of about 30% women on board. The notion that women are lacking the "proper" human capital for holding directorships is completely debunked by evidence from the United States and the United Kingdom.

Women directors have been found to create a value-decreasing impact in US firms with moderate degrees of management entrenchment (Adams & Ferreira, 2009; Gul et al., 2011). While Adams and Ferreira (2009) show that more gender diverse boards spend more time on supervising managers, and discover a negative link between the proportion of females on the board and TQ, Carter et al. (2010), He and Huang (2011), and Marquez-Cardenas et al. (2022) found no relationship between proportion of WOB and Return on Assets (ROA) or TQ.

The recent McKinsey report on diversity and inclusion (2020) finds a 4% increase in gender diversity in the North-American region from its last survey in 2015. World Economic Forum's "Global Gender Gap Report 2023" substantiates the same with North America achieving the highest gender parity score at 77.6% on the women's economic participation and opportunity subindex. Canada and the US also report an improvement in their current gender parity scores (Table 2).

Europe and the UK

Brahma et al. (2020) investigated the link between board gender diversity, chosen female characteristics, from a sample of FTSE 100 firms in the United Kingdom. A positive and significant association was revealed, based on critical mass theory, and assessing gender diversity as levels of female representation in boardrooms. So, when three or more females are present on the board, the results become

quite substantial and obvious than when only two or lesser females are present. Green and Homroy (2017), Nadeem et al. (2019), and Gharbi and Othmani (2022) record similar positive relationships. Nadeem (2019) looked at how WOB may manage the company's risk-reward relationship using "group dynamics process." The findings show a negative link between presence of WOB and company risk, but a positive impact of women and firm risk on firm profitability, based on a large dataset of listed enterprises in UK. Punaire et al. (2022) endorse the same results by applying Shannon index as gender proxy. Gregory-Smith et al. (2013) found no link at all.

The commercial rationale for more women on company boards is supported by evidence from a Russian study (Garanina & Muravyev, 2020). Firms with heterogenous boards have higher profits and market values, according to numerous identification methodologies, alternative metrics of gender diversity, and several performance metrics.

Marinova et al. (2010) used data from the Netherlands and Denmark and revealed using TQ as a performance indicator, that BGD has no influence on corporate success. Rose (2007) looked at a sample of Danish firms on the Copenhagen Stock Exchange (1998-2001) and concluded that having a female on the board had no effect on the company's success, whereas Smith et al. (2006) find a positive link between BGD and a host of corporate performance metrics. In Spain as well, Campbell and Minguez-Vera (2008) discovered a positive influence of gender diversity on TQ while Safiullah et al. (2022) found a negative link with TQ but positive with ROA & ROE.

Ahern and Dittmar (2012) demonstrate that mandating 40% quotas for female directors on boards of Norwegian public companies lowers company value. The results are ascribed to the theory that the law drives corporations to appoint younger, less experienced women as directors. In a cross-country study, Labelle, Francoeur, and Lakhil (2015) discovered that legislating gender diversity on boards had a negative influence on the association between gender diversity and corporate success. The effect of the gender quota policy has spurred research on the policy's requirement, underlying institutional causes, and ethical difficulties.

The European region beats all others with the highest gender parity at 76.3% across all subindexes (Global Gender Gap Report, 2023), thus supporting the business case for gender diversity. Iceland, Norway, and Finland emerge as the best performers in the world. The FTSE Women Leaders Review 2023 reported 40.2% women representation on FTSE 350 companies through its voluntary business-led approach which is a positive outcome towards a gender egalitarian society (Table 3).

Table 2: Review of Studies for American Region

Sr. No.	Authors	Year of Publication	Journal of Publication	Market in Focus	Theoretical Foundation	Dependent Variable	Independent Variable	Sample	Link/Sign
1	Erhardt et al.	2003	Corporate Governance: An International Journal of Business in Society	US	AT	ROA, ROI	% FD	112 Fortune companies (1993-1998)	Positive
2	Francoeur et al.	2008	Journal of Business Ethics	US	AT, SHT	ROS, ROA, ROE	% FD	230 large Canadian firms (2002-2004)	Positive
3	Miller & Triana	2009	Journal of Management Studies	US	Behavioural & Signalling Th.	ROI, ROS	% FD, BI	326 Fortune 500 Firms (2002-2005)	Inconclusive
4	Adams & Ferreira	2009	Journal of Financial Economics	US	AT	TQ, ROA	% FD, FDV	S&P 500 firms (1996-2003)	Negative
5	Carter et al.	2010	Corporate Governance: An International Review	US	RDT, AT, HCT	ROA, TQ	FD(n)	S&P 500 index companies (1998-2002)	No Relationship
6	Jurkus et al.	2011	Journal of Business Research	US	AT	ROA, Agency Costs	% FD, FDV	668 Fortune 500 Firms (1995-2005)	Positive
7	He & Huang	2011	Academy of Management Journal	US	AT	ROA	BI	530 US Manufacturing firms (2001-2007)	No Relationship
8	Dezso & Ross	2012	Strategic Management Journal	US	NA	TQ, ROA, ROE	FDV	S&P 1500 firms (1992-2006)	Positive
9	Conyon & He	2017	Journal of Business Research	US	Threat Rigidity, Job Sorting & Matching Th.	TQ, ROA	% FD	3634 publicly traded US Firms (2007-2014)	Positive
10	Moreno-Gomez et al.	2017	Gender in Management: An International Journal	Columbia	UET	ROA, ROE	% FD, FDV	54 Columbian listed firms (2008-2015)	Positive
11	Chen et al.	2018	Journal of Empirical Finance	US	NA	TQ, ROA	% FD	1224 firms on NBER Patent database (1998-2006)	Positive
12	Wiley & Monllor-Tormos	2018	Journal of Leadership & Organisational Studies	US	CMT	TQ, ROA, ROI	% FD, FD(n)	Fortune 500 Firms (2007-2014)	Positive with critical mass
13	Owen & Temesvary	2018	Journal of Banking and Finance	US	NA	ROA, Revenue to Expense Ratio, Sharpe Ratio, Annual Stock Price Growth	% FD, BI	87 large US Banks (1999-2015)	Positive with critical mass
14	Fernando et al.	2020	Journal of Business Research	US	UET	TQ, ROA	% FD	2635 US Firms (1992-2015)	Positive
15	Dang et al.	2020	Economic Modelling	US	AT, UET, CMT	ROA	% FD, BI	369 S&P 500 Firms (2004-2015)	Positive

Sr. No.	Authors	Year of Publication	Journal of Publication	Market in Focus	Theoretical Foundation	Dependent Variable	Independent Variable	Sample	Link/Sign
16	Mastella et al.	2021	Gender in Management: An International Journal	Brazil	AT	ROA, ROE, TQ	FD(n)	150 Publicly traded firms (2010-2018)	Positive
17	Marquez-Cardenas et al.	2022	Journal of Sustainable Finance	6 Latin-American Countries	AT, RDT	ROA	% FD	243 firms (across 6 major sectors) in 6 Latin-American countries (2012-2018)	No Relationship

Source: Based on author's own excel mapping.

Notes: %FD: Percentage/Proportion/Fraction of Female Directors; FD(n): Number of female directors; BI: Blau's Index; SI: Shannon Index; FDV: Female Dummy Variable; NA: Not Applicable/Specified.

Table 3: Review of Studies for Europe and UK

Sr. No.	Authors	Year of Publication	Journal of Publication	Market in Focus	Theoretical Foundation	Dependent Variable	Independent Variable	Sample	Link/Sign
1	Smith et al.	2006	International Journal of Productivity and Performance Management	Denmark	NA	Gross profit/Net sales, Contribution margin/Net sales, Operating income/net assets, Net income after tax/Net assets.	% FD	2500 large Danish firms (1993-2001)	Positive
2	Caspar Rose	2007	Corporate Governance: An international journal of business in society	Denmark	NA	TQ	FDV, % FD, BI, SI	Danish firms on Copenhagen Stock Exchange (1998-2001)	No Relationship
3	Campbell and Mínguez-Vera	2008	Journal of Business Ethics	Spain	NA	TQ	FDV, % FD, BI, SI	68 Non-financial firms on Madrid Stock Exchange (1995-2000)	Positive
4	Marinova et al.	2010	The International Journal of Human Resource Management	Netherlands & Denmark	UET	TQ	% FD, FDV	102 Dutch companies on Euronext, Amsterdam & 84 Danish companies on OMX Nordic Exchange Copenhagen (2007)	No Relationship
5	Haslam et al.	2010	British Journal of Management	UK	NA	ROA, ROE	Women on board(Y/N), % FD	126 FTSE-100 Index firms (2001-2005)	No link for ROE, ROA & Negative link with at least one woman on board (TQ)
6	Böhren & Strøm	2010	Journal of Business Finance & Accounting	Norway	NA	TQ, ROA, ROS	% FD	203 firms on Oslo Stock Exchange (1989-2002)	Negative

Sr. No.	Authors	Year of Publication	Journal of Publication	Market in Focus	Theoretical Foundation	Dependent Variable	Independent Variable	Sample	Link/Sign
7	Gallego-Álvarez et al.	2010	Spanish Accounting Review	Spain	AT, RDT	TQ, ROA, ROE, ROS, ROAN, MUB	% FD	96 Spanish corporations on Madrid Stock Exchange (2004-2006)	Inconclusive
8	Ahem & Dittmar	2012	The Quarterly Journal of Economics	Norway	NA	TQ	% FD	248 public firms on Oslo Stock Exchange (2001-2009)	Negative
9	Joecks et al.	2012	Journal of Business Ethics	Germany	CMT	ROE	FDV, BI	151 German listed firms (2000-2005)	Positive with Critical Mass
10	Lucckerath-Rovers	2013	Journal of Management and Governance	Netherlands	RDT	ROS, ROE, ROIC, EBIT, Stock Price Growth, TSR	% FD	99 Dutch Companies on Amsterdam Euronext Stock Exchange (2005-2007)	Positive
11	Gregory-Smith et al.	2013	The Economic Journal	UK	NA	ROA, ROE, Price to Book Ratio, TSR	Gender of the director who has stepped down	FTSE 350 Firms (1996-2011)	No Relationship
12	Opstrup & Villadsen	2014	Public Administration Review	Denmark	NA	Operating Result, Budget Overruns	BI, FDV	98 Danish Municipalities (2008-2012)	Positive
13	Isidro & Sobral	2015	Journal of Business Ethics	16 European Countries	AT, RDT, HCT, SCP	TQ, ROA, ROS	% FD, FDV	Financial Times 2011 classification of the 500 largest European firms (2010-2012)	Inconclusive
14	Reguera-Alvarado et al.	2015	Journal of Business Ethics	Spain	AT, RDT, SHT	TQ	% FD, BI, SI	125 Non-financial firms on Madrid Stock Exchange (2005-2009)	Positive
15	Bennouri et al.	2017	Journal of Banking and Finance	France	RDT	ROA, ROE, TQ	% FD	394 CAC firms (2001-2010)	Positive with ROA, ROE Negative with TQ
16	Green & Homroy	2017	European Economic Review	UK	NA	ROA, MTBR	% FD	EuroTop 100 firms (2004-2015)	Positive
17	Ali et al.	2017	Research in International Business and Finance	France	AT, SHT	ROA, ROE	% FD	108 French firms on CAC 40 Index (2011-2013)	Positive
18	Nadeem et al.	2019	International Review of Economics and Finance	UK	NA	ROA	% FD, FDV, BI	424 firms on UK Stock Exchange (2007-2016)	Positive

Sr. No.	Authors	Year of Publication	Journal of Publication	Market in Focus	Theoretical Foundation	Dependent Variable	Independent Variable	Sample	Link/Sign
19	Slama et al.	2019	Cogent Economics & Finance	France	CMT, AT	ROA, TQ	FDV, % FD	89 Firms on CAC (2008-2011)	Positive with Gender Quota French Code
20	Yang et al.	2019	The Leadership Quarterly	Norway	RDT	Operating Income/ Assets, ROA, TQ, MTBR	% FD	622 firm-year observations in Norway (2002-2008)	Negative
21	Brahma et al.	2020	International Journal of Finance & Economics	UK	CMT	ROA, TQ	3 FDVs	FTSE 100 firms (2005-2016)	Positive
22	Garanina & Muravyev	2020	Emerging Markets Review	Russia	CMT	MTBR, TQ, ROE, ROA	% FD, FDV	More than 550 Russian publicly traded firms (1998-2014)	Positive
23	Fernández-Tenprano & Tejerina-Gaite	2020	Corporate Governance: An international journal of business in society	Spain	AT	ROA, MTBR	Proportion of Male Directors	87 Non-financial spanish firms (2005-2015)	No Relationship
24	Rubino et al.	2021	Meditari Accountancy Research	Italy	AT, RDT	ROA	% FD (Independent & Executive)	Industrial firms on Milan Stock Exchange (2006-2015)	Positive
25	Soare et al.	2021	International Journal of Productivity and Performance Management	Belgium	NA	23 Financial Indicators (ROA, EBIT, Quick Ratio etc.)	% FD	4080 Belgian firms (2010 & 2017)	Negative for 10 indicators, No link for other 13 indicators
26	Puntaire et al.	2022	International Journal of Entrepreneurial Behaviour & Research	UK	UET	ROA	SI	309 Manufacturing SMEs in UK (2009-2019)	Positive
27	Gharbi & Othmani	2022	Corporate Governance: An International journal of business in society	France	AT, CMT	ROA, TQ	% FD	284 non-financial French firms listed on Euronext Paris (2009-2017)	Positive with critical mass Neutral, otherwise
28	Safiullah et al.	2022	Journal of Behavioral and Experimental Finance	Spain	AT, RDT, HCT	TQ, ROA, ROE, BEP (Basic Earning Power Ratio)	% FD, FDV, BI, SI	165 firms listed on Spanish Stock Exchange Commission (CNMV)	Positive with ROA, ROE & BEP Negative with TQ
29	Tao-Schuchardt & Kammerlander	2023	Journal of Family Business Strategy	Europe	AT, UET	ROA	% FD, FDV	1134 publicly listed European firms (2010-2018)	Positive (But weak for family firms)

Source: Based on author's own excel mapping.

Africa and Middle East

We find a dearth of established gender studies in the African regions, owing to the steady development rate. People lack awareness and many governments are still to bring out legislations on gender equity.

Between 2008 and 2013, Gyapong et al. (2016) used a sample of 245 South African listed firms and found that both, board gender and ethnic diversity had a positive and significant effect on business value. They also discovered that when three or more female directors are present (critical mass), the boost in firm value is even larger.

In Turkey, Ararat et al. (2015) developed several proxies for female engagement, but found no grounds to prove that female directors affect firm value and profitability. Female directors have been shown to enhance firm value only when women work more actively while participating in board governance by serving on board committees and being well-represented as well.

Kılıç and Kuzey (2016) found a positive association in Turkey, while Solakoglu and Demir (2016) reported inconclusive results. Asare et al. (2022) also recorded insignificant relationships in their study on banks from 26 African countries. In Nigeria, a negative association between WOB & FP (measured through ROA) was found (Ujunwa, 2012). In terms of initiatives of the government, regulators, and practitioners, much is still to be formalised in this region.

North Africa and the Middle East remain farthest away from gender parity with a score of 62.6% while Sub-Saharan Africa closes at 68.2% (Global Gender Gap Report, 2023). Namibia, Rwanda, and South Africa emerge as the best countries that foster gender equality.

Asia Pacific

Using a sample of Asian enterprises from Hong Kong, Malaysia, Singapore, and South Korea, Low (2015) demonstrates that an increase in the number of female directors on the board has a positive impact on company success as assessed by return on equity (ROE).

For businesses listed on the Australian Securities Exchange, Chapple and Humphrey (2014) compared the performance of stock and asset portfolios of companies that had gender diverse boards vs. those that did not. There was no evidence of a link between board diversity and overall firm performance. A similar result was reported by Yarram and Adapa (2023) by employing the Blau and Shannon Index as gender proxies. Wang and Clift (2009), on the contrary, find that while bigger Australian firms tend to have more female board members, board gender diversity has no significant

influence on accounting metrics ROA and ROE. Bonn et al. (2004) carried out a comparative study and found a positive association among proportion of WOB & FP in Australia but no such link for Japan.

In their novel research using Asian data, Julizaerma and Sori (2012) contend (applying OLS regression) a positive connection between WOB of directors and company performance in Malaysian firms. Marimuthu and Kolandaisamy (2009) discover no significant associations employing ROA and ROE throughout the 2000–2006 period in their Malaysian study. However, in a similar setting, Pheng Lim et al. (2019) infer a negative relation between the two variables.

According to Liu's (2014) research of Chinese boardrooms, female executive directors had a stronger positive influence on business performance than female independent directors, suggesting that the executive effect overcomes the monitoring effect. On the other hand, Chen and Hassan (2021), in their attempt to discover a negative link between TQ and performance

Mahadeo et al. (2012) revealed a positive association between BGD and firm value, for firms listed on the Mauritius Stock Exchange. In Indonesia, Darmadi (2011) demonstrates a negative link between the presence of WOB on TQ and ROA, undercutting the rationale for more gender diverse boards.

Sarkar and Selarka (2020) looked at the influence of female directors on the performance of Indian companies, where women directors had a positive and substantial influence on business performance as measured by ROA and Tobin's Q. Maji and Saha (2021) also reported a positive link taking Blau's and Shannon's Index as independent variable. Srivastava et al. (2018) documented a positive link, with ROA but a negative link with Cost of Equity (COE). Kagzi and Guha (2018) found no relationship while Singh et al. (2022) reported insignificant results. Sen & Mukherjee (2019) used a unique variable, i.e., market value added to net worth, as the performance proxy on a sample of NSE listed firms and reported a positive link with independent female directors but no link with other independent variables. The Securities and Exchange Board of India (SEBI) has mandated that all listed businesses have at least one female director on their board of directors (Sikand, Dhami & Batra, 2013).

The positive impacts of gender diversity, tend to be diminished in countries where women are more economically engaged and empowered. This could be due to tokenism, but it implies that appointing female directors or imposing gender quotas can harm a company's performance in nations where cultural opposition is strong. In contrast to Italy and Norway, where governments have imposed gender quotas, "Asia's lack of government engagement is most noticeable"

Table 4: Review of Studies for Africa and Middle East

Sr. No.	Authors	Year of Publication	Journal of Publication	Market in Focus	Theoretical Foundation	Dependent Variable	Independent Variable	Sample	Link/Sign
1	Augustine Ujunwa	2012	Corporate Governance: the International Journal of Business in Society	Nigeria	AT, RDT	ROA	% FD	122 firms on Nigerian Stock Exchange (1991-2008)	Negative
2	Ararat et al.	2015	Corporate Governance: An International Review	Turkey	AT, SPT	ROE, MTBR	BI	100 large firms on BIST-100 Index 2006	Positive
3	Gyapong et al.	2016	Journal of Business Finance & Accounting	South Africa	TST, CMT	TQ	% FD, FDV, Diversity(Y/N)	245 firms on Johannesburg Stock Exchange (JSE) (2008–2013)	Positive
4	Kılıç & Kuzey	2016	Gender in Management: An International Journal	Turkey	AT, RDT	ROA, ROE, ROS	BI, % FD, FDV	149 Non-financial firms on BIST (2008-2012)	Positive
5	Solakoglu & Demir	2016	Management Decision	Turkey	NA	ROA, ROE, Avg. Monthly Return	Gender Dummy (when CEO/GM is a woman), FD(n), % FD	BIST-100 Index (2002-2006)	Inconclusive
6	Sarhan et al.	2018	International Journal of Finance & Economics	Middle East and North African countries	AT, RDT, CMT	ROA, TQ	% FD	100 non-financial firms on national stock exchanges (2009-2014)	Positive
7	Paul Assenga et al.	2018	Corporate Governance: An International Journal of Business in Society	Tanzania	AT, RDT	ROA, ROE	% FD	10 firms on DSE (2006-2013)	Positive
8	Ararat & Yurtoglu	2020	Emerging Markets Review	Turkey	CMT	TQ	FDV, % FD	268 firms on BORS Istanbul (2011-2018)	No Relationship
9	Okoyeuzo et al.	2021	Gender in Management: An International Journal	Nigeria	AT, RDT	EPS, ROA, TQ	% FD	15 Deposit Money Banks (2006-2018)	Positive
10	Asare et al.	2022	Journal of Money and Business	26 African Countries	RDT	Net Interest Margin, Risk-Adjusted ROA	% FD	366 Banks from 26 countries in 5 sub-regions of Africa (2007-2015)	Insignificant
11	Andoh et al.	2022	Corporate Governance: The International Journal of Business in Society	Ghana	AT, RDT, SHT, SWT	ROA, ROE, TQ	% FD	21 Listed firms(16 Non-financial firms + 5 Banks) on Ghana Stock Exchange (2004-2016)	Positive Significant FOR Listed Non-financial firms Insignificant for Listed Banks
12	Taha Almarayeh	2023	Journal of Financial Reporting and Accounting	Jordan	AT, RDT, TST	ROA, EPS, Dividend Yield	% FD	51 Non-financial firms on Amman Stock Exchange (2009-2018)	No Relationship

Source: Based on author's own excel mapping.

Table 5: Review of Studies for Asia Pacific

Sr. No.	Authors	Year of Publication	Journal of Publication	Market in Focus	Theoretical Foundation	Dependent Variable	Independent Variable	Sample	Link/Sign
1	Bonn et al.	2004	Asian Business & Management	Japan, Australia	AT, RDT	ROA, MTBR	% FD	169 Japanese and 104 Australian Manufacturing firms (1998-1999)	No Relationship in Japan Positive in Australia
2	Wang & Clift	2009	Pacific Accounting Review	Australia	AT	ROA, ROE, Shareholder Return	FD(n), % FD	243 large firms (2003-2006)	No Relationship
3	Mahadeo et al.	2011	Journal of Business Ethics	Mauritius	NA	ROA	FD(n), % FD	42 firms on Stock Exchange of Mauritius (2007)	Positive
4	Darmadi	2011	Corporate Ownership and Control	Indonesia	NA	ROA, TQ	% FD, BI	169 IDX Firms (2007)	Negative
5	Liu et al.	2013	Journal of Corporate Finance	China	RDT, TST, CMT	ROS, ROA	% FD, FDV	Chinese listed firms (1999 to 2011)	Positive
6	Nguyen et al.	2014	International Review of Economics and Finance	Vietnam	AT, RDT	TQ	% FD, FDV, BI	120 Firms on Ho-Chi-Minh Stock Exchange (HOSE) & Hanoi Stock Exchange (HNX) (2008 -2011)	Positive
7	Chapple & Humphrey	2014	Journal of Business Ethics	Australia	NA	ROA, TQ, Stock Returns, Book-to-Market & Market values of stock	% FD, FDV	577 ASX Listed firms (Jan 2004 - Sept 2011)	No Relationship
8	Low et al.	2015	Pacific-Basin Finance Journal	Hong Kong, South Korea, Malaysia and Singapore	AT, RDT, LT, SWT, SHT, Behavioural Th.	ROE	% FD	5503 Asian firms (2012-2013)	Positive
9	Vafaei et al.	2015	Australian Accounting Review	Australia	AT, RDT	ROA, ROE, TQ, Economic Measure (CFO/TA)	% FD, FDV	Top 500 firms listed in Australia (2005-2011)	Positive

Sr. No.	Authors	Year of Publication	Journal of Publication	Market in Focus	Theoretical Foundation	Dependent Variable	Independent Variable	Sample	Link/Sign
10	Srivastava et al.	2018	Management Decision	India	CMT,LT,Social Identity Th.	COE, ROA	FD(n), Independence of a female director	20 NSE Listed Companies (2001-2015)	Negative with COE Positive with ROA
11	Kagzi & Guha	2018	Benchmarking: An International Journal	India	RDT, Social Identity Th.	TQ	BI	126 KIFs on NSE (2010-2014)	No Relationship
12	Duppatti et al.	2019	Applied Economics	India and Singapore	SWT, RDT	ROA, TQ	% FD	425 SGX & 1435 NSE Listed (2005-2015)	Positive
13	Pheng Lim et al.	2019	Equality, Diversity and Inclusion: An International Journal	Malaysia	AT	TQ	% FD, FDV, BI, SI	928 firms on Bursa Malaysia (2010-2016)	Negative
14	Aggarwal et al.	2019	International Business Review	India	AT, RDT	TQ, CAR	BI	380 firms on NIFTY 500 Index of NSE (2006-2015)	Positive for standalone firms, Negative for group-affiliated firms
15	Unite et al.	2019	Int Advances in Economic Research	Philippine	AT, SPT, Investor Bias Th.	ROA, ROE, TQ	% FD, BI, SI	200 firms on Philippine Stock Exchange-PSE (2003-2014)	No Relationship
16	Ullah et al.	2019	Corporate Governance: An international journal of business in society	Pakistan	AT	ROE, ROA, TQ	FDV, CEO Dummy	220 Non-financial firms on Pakistan Stock Exchange (2010-2017)	Positive
17	Sen & Mukherjee	2019	Journal of Commerce & Accounting Research	India	NA	Market Value Added to Net Worth	FD(n), % FD (Independent), Educated Female Directors & Overseas FD	139 Non-financial firms listed on NSE (2011-2016)	Positive with Independent Female Directors No Relationship with other variables
18	Sarkar & Searlarka	2020	Emerging Markets Review	India	SWT, AT	TQ, ROA	FDV	1348 & 575 NSE Listed firms (2005-2016)	Positive
19	Chen & Hassan	2021	International Journal of Accounting & Information Management	China	AT, UET	TQ	% FD, FDV	461 firms on GEM Boards (2016-2018)	Negative

Sr. No.	Authors	Year of Publication	Journal of Publication	Market in Focus	Theoretical Foundation	Dependent Variable	Independent Variable	Sample	Link/Sign
20	Maji & Saha	2021	Management Research Review	India	AT, RDT	Market Capitalization (LnMC)	BI, SI	100 Non-financial firms on BSE (2013-2018)	Positive
21	Singhania et al.	2022	International Journal of Emerging Markets	India	AT, RDT	ROA, TQ	% FD, BI, SI	428 Non-financial S&P BSE 500 listed firms (2014-2021)	Positive with TQ if women present on prominent board committees. Insignificant with ROA
22	Lee & Thong	2022	Equality, Diversity and Inclusion: An International Journal	Global Sample of 30 Countries	NA	TQ	% FD	187 Listed tourism firms in 30 countries (2015-2020)	Positive
23	Singh et al.	2022	Society and Business Review	India	AT, RDT	TQ	% FD, BI, SI	26 IT firms listed on BSE (2013-2021)	Insignificant
24	Sharma & Dey	2022	Journal of Commerce & Accounting Research	India	NA	ROA, ROE, TQ, Net Interest Margin, Net NPAs	FD(n)	10 Large Public Sector Banks (2013-2019)	Insignificant
25	Yarram & Adapa	2023	International Journal of Managerial Finance	Australia	RDT, TST, CMT	ROA	% FD, BI, SI	Firms on ASX 300 Index (2004-2016)	No Evidence
26	Tariqul Islam et al.	2023	International Journal of Emerging Markets	Bangladesh	AT, RDT, Gender Identity Th.	ROA	% FD	183 Non-financial firms listed on Dhaka Stock Exchange (2007-2017)	Positive with Critical Mass
27	Abbas & Frihatni	2023	Journal of Capital Markets Studies	Indonesia	Social Identity Th.	Logit Distress	Nominal Scale (1 for placing women & men, 0 for only men)	467 Public firms (2018)	Lower financial distress for firms with gender diversity

Source: Based on author's own excel mapping.

(Catalyst, 2012a). Despite lobbying by organisations such as Women Corporate Directors (WCD) for gender equality on boards, “female boardroom appointments in most Asian nations have remained low in contrast to Western ones” (Catalyst, 2012b). Given the patriarchal structure of Asian countries, this conclusion is unsurprising. In terms of women’s economic participation and opportunity subindex, Southern Asia remains farthest away from parity, closing just 37.2% of the gender gap. Pakistan and Afghanistan appear at the bottom of the regional and global ranking tables. In the East-Asia and Pacific region, Philippines and Singapore record the highest parity for this subindex.

Variables and Measurements

In this section, we shed light on the key metrics employed in previous research as proxies for measuring diversity and firm performance.

Measuring Women on Board

Our study’s independent variable is the presence of females on the board of directors. “A gender diverse board has been defined as one that includes at least one female director” (Adams & Ferreira, 2009).

Female board membership has been measured by a dummy variable indicating their presence which takes value “1” if there is at least one woman on the board, otherwise “0” (Nguyen et al., 2014; Ararat & Yurtoglu, 2020; Saifullah et al., 2022), and a continuous variable, reflected by the percentage of female directors on board (Rose, 2007; Jurkus et al., 2011; Sen & Mukherjee, 2019; Taha Almarayeh, 2023).

The primary measure of gender diversity in this study is the proportion of female directors on the board of directors which is determined by dividing the total number of directors by the number of female directors. This proxy has been used in earlier investigations with comparable results (Rose, 2007; Campbell & Minguez-Vera, 2008; Sarhan et al., 2018; Pheng lim et al., 2019; Chen & Hassan, 2021).

To measure diversity, Adams and Ferreira (2009), and Ntim (2015) used two key metrics: (i) the proportion of women/ethnic minority directors on the board; (ii) a dichotomous variable. Three dummy variables for gender diversity are created in some studies. The dummy variable takes the value of ‘1’ if one/two/three female directors is/are present on the board and ‘0’ otherwise (Liu et al., 2014; Brahma et al., 2020; Garanina & Muravyev, 2020).

The second metric comes from the critical mass hypothesis. According to this theory, for the rate of adoption of a social

system’s innovation to become self-sustaining and produce new development, people must accept it (Kanter, 1977). A critical mass of three or more women is necessary to bring about a significant change in the boardroom (Torchia et al., 2011; Gharbi & Othmani, 2022; Tariqul Islam et al., 2023).

Some researchers (Campbell & Minguez-Vera, 2008; Nguyen et al., 2014; Ararat, 2015; Uribe et al., 2018, Singh et al., 2022) have employed Blau’s Index as a measure of board diversity. This index may be expanded to additional attributes because it is based on qualitative distinctions among members of a specific group (Harrison & Klein, 2007). It has been used to assess the board’s diversity (of race, experience, gender, or ethnicity). This index is used to calculate diversity for each characteristic and then to create a composite board-level diversity index based on Blau’s findings (1977). The gender diversity Blau’s index goes from 0 to 0.5, indicating that the board has an equal number of men and women on it.

Another metric used in prominent studies (Campbell & Minguez-Vera, 2008; Pheng Lim et al., 2019; Maji & Saha, 2021) is the Shannon Index. The Shannon index has properties that are qualitatively comparable to those of the Blau index since it is a logarithmic measure of diversity. However, it will always produce a higher value than the Blau index and is more sensitive to tiny differences in the gender makeup of boards. The index’s lowest value is zero, while the highest level of diversity is achieved when both genders are equally represented, providing a score of 0.69.

Measuring Firm Performance

Most studies in the United States have used Tobin’s Q as a performance measure to analyse the relationship between business performance and governance characteristics. Given that stock market metrics are sensitive to investors’ expectations, Bhagat and Bolton’s (2008) choice of accounting performance measures is supported (Jackling, 2009).

TQ is a widely used statistic in the business world for determining the worth of a company (Lang et al., 2003; Campbell & Minguez-Vera, 2008; Adams & Ferreira, 2009; Mishra & Kapil, 2018). It indicates market expectations about a company’s capacity to generate future cash flows, as well as the risk associated with that ability, unlike accounting-based financial measures which are derived from past events that are reported in accounting.

Gyapong et al. (2016) adopted TQ for three reasons: First, ROA and ROE are short-term indicators of performance, but TQ assesses long-term company value (Thomas & Eden, 2004). Second, accounting measures of performance (ROA and ROE) can be manipulated for short-term earnings in

comparison to TQ. Finally, TQ is a common company value metric in “governance-to-value studies” (Black et al., 2014).

A bulk of empirical research (Adams & Ferreira, 2009; Augustine Ujunwa, 2012; Marquez-Cardenas et al. and Singhanian et al., 2022) used ROA or TQ or both as firm performance metrics. Sarhan (2018) has conducted research on this topic using TQ, a market-based statistic, and ROA, an accounting measure.

Papangkorn et al. (2019) concentrate on six key company success factors: ROA; basic earning power ratio (EBIT over total assets); earnings before interest, taxes, depreciation, and amortisation over total assets (EBITDA over total assets); TQ; market-to-book ratio of equity (MTB); and Peters and

Taylor’s Q (2017). The first three performance indicators are accounting-based, whereas the latter three are stock-based performance indicators. The researchers adopt both, market and accounting-based metrics as accounting-based measures might respond to the changes in the company’s governance mechanism with much more delays (as per the accounting cycle), than the market-based metrics (Carton & Hofer, 2006). In recent studies involving banks, we find Net Interest Margin (calculated as Interest Revenue - Interest Expense/Total Assets) as a commonly used performance metric (Asare et al. and Sharma & Dey, 2022).

The definition/description of the proxies used to measure firm performance have been presented below.

Table 6: Firm Performance Measures and Description

Dependent Variable	Description
ROA (Return on Assets)	Ratio of Operating Income to Net Assets
ROE (Return on Equity)	Ratio of Operating Income to shareholders' equity
TQ (TOBIN'S Q)	Ratio between market value & assets of a firm (Carter et al., 2007)
ROS (Return on Sales)	Ratio of Operating Income and Net Sales
ROI (Return on Investment)	Ratio of Net Income to Invested Capital
EPS (Earning Per Share)	Ratio of profit after tax to total number of shareholders
MTBR (Market to Book Ratio)	Ratio of market value of equity to book value of equity
COE (Cost of Equity)	Calculated as per CAPM-: Risk-free Return + Beta(Market rate of return Minus Risk-free rate of return)
Stock Returns	Aggregate returns generated by portfolios of firms
Economic Performance Measure	Cash flow from operations divided by Total Assets
Market Capitalization	Natural Logarithm of Market Capitalization of the firm
TSR (Total Shareholder Return)	Realized rate of return incorporating dividend payments and share price appreciation (adjusted for share splits)
ROIC (Return on Invested Capital)	Net operating profit after tax divided by Invested Capital
Avg. Monthly Return in a year	Standard deviation of the monthly returns in a year (Market Performance Measure)
ROAN (Net Return on Assets)	Ratio of Net Income and Net Assets
MUB	Ratio of gross Margin to Net Sales
EBIT (Earnings before Interest & Tax)	Revenue Minus expenses, excluding interest and taxes
Stock Price Growth	Compounded annual growth rate of stock

Source: Author’s own tabulation

DISCUSSION AND CONCLUSION

Gender diversity on boards of directors has been studied extensively to see how it affects company performance and characteristics. This paper attempts to pave out a path for future gender related research on board composition and

structure in companies. Although this research has yielded a lot of information, the empirical data shows that the results are varied and that there is a lack of requisite integration and consolidation.

During our investigation, we discovered several noteworthy patterns to keep an eye on. To begin with, we anticipate

that as the workforce demographics in Europe, Asia, and the Americas change, more women will join the board of directors. Second, corporate governance scandals have resulted in new gender laws (French Gender Quota Law, 2011; Companies Act of India, 2013; Germany Gender Law, 2015) controlling firm board composition structures and processes, as well as the duties and responsibilities of independent directors. It is suggested that board diversity, including female representation, be improved in future investigations.

The pool of skilled, experienced women is nearly endless. However, industry and government must work together to meet the expectations of the talented young women so they may fully harness their abilities for the benefit of businesses, and the economy.

Governments all over the globe have become increasingly aware of the relationship between gender equality, particularly in the labour market, and economic development and prosperity, both via their own efforts and through their involvement in raising healthier, better educated children (Economist, 2006). Many governments monitor the implementation and efficacy of diversity policies and practices, and they design interventions based on reliable research findings. Female diversity research on corporate boards is an important tool for creating the framework for more equal gender representation at the highest levels of corporate decision-making.

According to the most recent Hampton-Alexander review (2023) FTSE companies have already met the 40% target for WOB three years ahead of schedule. The outcomes of this study show that the proposals for increased female representation on boards of directors and female executive directors are positive moves in the right direction.

To summarise, in today's complex and rapidly changing business environment, it appears that the advantages associated with heterogeneous groups' knowledge, perspective, creativity, and judgement may be superior to those associated with less diverse sets of people when it comes to improving the quality of decision making. Further research on "Board Gender Diversity" can be carried out on issues that relate board diversity to sustainability aspects like social reporting, ESG, risk ratings, sustainable finance, etc. Study on women on corporate boards is critical not just for academic purposes, but also for establishing the framework for change, resulting in more equitable and effective gender representation at corporate decision-making levels.

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WHAT FACTORS INFLUENCE THE FINANCIAL RISK TOLERANCE? A FURTHER EXAMINATION ON THE NEXUS BETWEEN FINANCIAL RISK TOLERANCE AND FINANCIAL ENVIRONMENTAL FACTORS

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Abstract *The consideration of risk tolerance plays a crucial role in the process of making optimal portfolio selections. In particular, the level of financial risk that an investor is willing to take, known as their financial risk tolerance (FRT), is sometimes regarded as the single most essential characteristic for the prediction of investor behaviour. In spite of this, it is a challenging endeavour since it is dependent on a wide variety of financial environment elements. For this reason, evaluating financial risk tolerance and identifying the elements that influence individual investors' views of the financial risks they face have been interest of research and investigations for significant years. This study investigates the relationship between the financial risk tolerance of individual equity investors and financial environmental factors. For this purpose, four indicators namely "financial anxiety, money ethics, financial stress, and financial satisfaction" were used to check the impact of financial environmental determinants on FRT. The present study was executed in the state of Kerala, and the information was collected from individual retail investors through the use of a predesigned questionnaire. The Structural Equation Modelling (SEM) technique was utilised to evaluate the model. The results indicate that financial anxiety, money ethics, financial stress, and financial satisfaction exert significant positive effects on FRT. The findings of the current study may offer important assistance to state and national policymakers in the process of creating investment policies.*

Keywords: *Financial Risk Tolerance, Risk Attitude, Investment, Individual Investors, Financial Environmental Factors*

INTRODUCTION

The study of investor behaviour has gained relevance in recent years as a result of the expanding presence of investment organisations together with the development in the pathways of investments such as mutual funds, debentures, shares, real estates, gold, and so on (Kannadhasan et al., 2016). This combination of factors has caused an increase in the number of investment opportunities. Planning for one's financial future and economy as a whole requires an understanding of one's level of tolerance with financial risk, as well as an evaluation of one's desire and ability to engage in risk-taking. In the modern period, the process of

making decisions on investments heavily incorporates behavioural finance. When deciding how to allocate their capital, investors in this market have access to a number of opportunities or alternatives from which to choose. The term "decision making" refers to the process of ultimately selecting the most advantageous option that is available to investors on the market. There are certain financial choices that are straightforward, while others are more challenging and need for a variety of different strategies to be taken. Over the course of the past few years, equities markets have become increasingly volatile and unpredictable (Thanki et al., 2020). Nanda et al. (2023) discovered a significant association between stock market decisions and macroeconomic conditions. The financial

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markets are becoming increasingly susceptible to the large-scale macroeconomic shocks that have the potential to disrupt markets on a global scale. When looking at the market from the point of view of an investor, the effect of market vulnerability is greater uncertainty and unpredictability. The notion of efficient markets, often known as rational investor conduct, has long been relied upon by market participants as a foundation for making judgements regarding financial matters.

In human life, risk is unavoidable. Within his or her comfort zone, every investor accepts a significant level of risk. When making a financial or investment decision, financial risk tolerance (FRT) is the degree to which they are comfortable with uncertainty or volatility in their investment returns (Kannadhasan et al., 2016; Faff et al., 2008; Grable, 2000; Grable & Lytton, 1999; Hallahan et al., 2003). Individual risk-taking ability varies from individual to individual and from period to period, depending on various circumstances. In terms of income, spending, savings, and investments, India's fast-growing economy has provided us with vast growth potential. Investors nowadays are more educated, have a broad understanding of investments, and have easy access to financial data. The most important aspect of investment planning is to keep one's risk profile in mind. Examining one's risk tolerance is essential since it affects the value of every investment option, and the ultimate aim of any financial activity is to maximise predicted revenue (Sulainman, 2012).

The level of risk that an investor is willing to take might also have an effect on the investments that they choose. Investors were able to display their risk tolerance through the process of risk evaluation. As a result, in this situation, the risks are linked to the uncertainties around investment returns. Investments in higher-risk assets are more likely to be made by investors who are actually willing to tolerate or accept risk, and vice versa (Corter & Chen, 2005). The FRT can be comprehended with the assistance of two different elements. The first aspect is that financial risk tolerance is determined by external aspects such as education and income (Roszkowski & Grable, 2010; Gibson et al., 2013). The second aspect is that it is dependent on the personal characteristics of investors such as their attitude, perception, and confidence, all of which are subject to change over time. Financial literacy is another major issue since it influences investors' ability to take on risk by discouraging and altering their investing behaviour (Syal, 2018). The level of financial risk that an individual investor is willing to take is unique to them, and this factor plays a role in their investing decision-making. Behavioural finance examined how psychological and psychographic variables affect investment choices (Antony, 2022). According to Snelbecker et al.

(1990), investors' willingness to take risks influences the opportunities they choose to pursue as investment prospects. People who have a high-risk tolerance are more likely to be interested in investing in high-risk assets, whilst those who have a low-risk tolerance would rather stay away from investments in these types of assets (Corter & Chen, 2005; Pompian, 2012; Nguyen et al., 2016).

Given the relevance of FRT in investment decisions, past research has looked at a variety of factors, including demographic, social, environmental, and psychological aspects throughout time in different nations. A factor that inspires this study is the lack of research on the significance of financial environmental characteristics in varying the degree of FRT among retail investors. When making personal investment and financial decisions, understanding and evaluating FRT is essential. In this regard, the study looks at the dynamics of financial environmental factors as a differentiating and classifying factor in retail investors' risk-taking behaviour.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

The amount of financial risk an individual is willing to take is an important factor to consider while making investment choices and working towards accomplishing financial objectives. Therefore, a primary variable that influences a person's decision-making behaviour in relation to investments is their level of comfort with the associated financial risks (Anbar & Eker, 2010). The individual ability to take on risk is a multifaceted topic, making it extremely complex and challenging to determine their level of risk tolerance (Kumar & Kumar, 2021). Investors and researchers have been interested in risk for hundreds of years, but efforts to investigate financial risk tolerance have just recently begun. The part that mental processes play in behavioural finance is not yet well-theorised. Therefore, some of the most significant characteristics associated with risk tolerance are discussed in this part, including those that come from fields other than finance, such as psychology, economics, and bio-sociology.

Several investigations on the impact of characteristics including financial anxiety, money ethics, financial stress, and financial satisfaction on financial risk tolerance have been conducted. According to Burchell (2003), "financial anxiety" is a psychiatric condition that describes a person's inability to properly cope with his or her own personal affairs. According to Archuleta et al. (2013), the definition of financial anxiety is "feeling anxious or worried about one's financial situation". Hayhoe et al. (2012) argued that a higher

level of wealth leads to a lower degree of financial concern among young investors. As a result, their risk tolerance is also low because of this. According to Andrews and Wilding (2004), financial stresses have an effect on financial anxiety, which in turn has an effect on one's tolerance for financial risk. Thanki et al. (2020) also discovered that financial worry has a favourable correlation with FRT. Therefore, it is reasonable to predict the following:

H1: Financial Anxiety is Significantly Related to FRT

A person who suffers from money worship, also known as an obsession with money, has a sort of money problem in which they feel that the only way to succeed in life is to amass a great deal of financial wealth. According to Grable and Joo (2004), an individual's money attitude is the primary element that determines their level of financial contentment. Lim (2003) claimed that people who have experienced adversity have a greater preoccupation with money, which in turn influences the way they handle their finances. Furnham and Argyle (1998) argued that an obsession with money is an indication of one's level of success, and this level of fixation has a direct bearing on an individual's risk tolerance. Thanki et al. (2020) also discovered that an obsession with money has a favourable correlation with FRT. Money ethics, as defined by Engelberg and Sjoberg (2007), was found to have a positive correlation with economic or financial risk. As a result, the following is to be anticipated:

H2: Money Ethics is Significantly Related to FRT

When money is limited, it can be difficult to satisfy even the most fundamental of one's financial obligations, which can lead to stress. Increasing one's wealth requires one to engage in the activities of saving, and investing. It is possible that the stress brought on by a lack of financial stability will influence these judgements. The way an individual reacts to stress emotionally, behaviourally, and cognitively could, in turn, have an effect on the decisions they make about their finances. According to Hilton and Devall (1997), financial stress may be defined as the subjective experience of worries and anxiety over one's financial situation, as well as a worsening of one's financial situation and difficulty in meeting family obligations. Weller and Helburn (2010) claimed that the connection between stress and financial decisions may be asymmetric, meaning that lower levels of financial stress may result in greater absolute financial decisions than higher levels of stress. Tran et al. (2018) also found that seventy-two percent of people indicate that concerns regarding their financial situation cause them stress. These concerns might

include things like being concerned about being able to pay their rent or being in debt. This is of the utmost importance given that worry about money has been linked to a wide range of health issues as well as mental choices. Based on the aforementioned arguments, it is proposed that:

H3: Financial Stress is Significantly Related to FRT

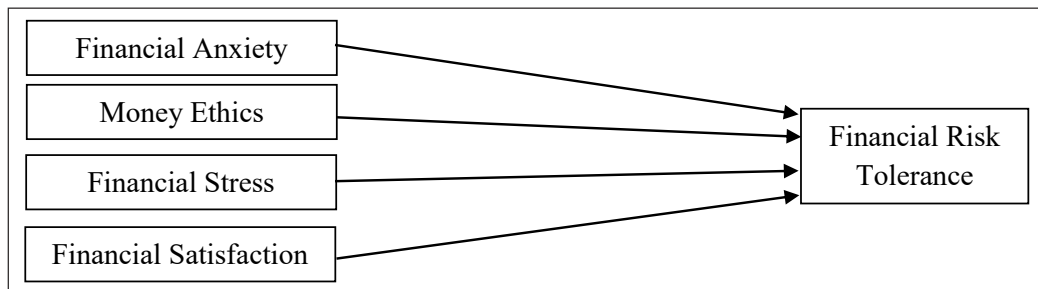
Financial satisfaction may be measured by how well their present and future financial commitments are covered by their available resources, whether those resources are adequate or insufficient. According to Archuleta et al. (2013), the term "financial satisfaction" relates to a person's contentment with their current financial condition. Xiao et al. (2009) identified that an individual's propensity to take financial risks is reduced, and their capacity to recover from financial setbacks is enhanced when they are financially secure. Grable and Joo provided their backing for this contention. According to Grable and Joo (2004), a higher risk tolerance also results in lower financial satisfaction. They found this to be the case. Asebedo and Payne (2019) claimed that if there is any incongruity between an individual's existing and targeted financial position, then the individual would likely experience lower financial pleasure despite having a high-risk tolerance. Rahman (2019) used happiness as a proxy for financial satisfaction and concluded that the former has a detrimental effect on the FRT. In accordance with these findings, Rahman et al. (2019) have demonstrated that one of the most important elements determining FRT is a person's level of financial satisfaction. In addition, Thanki et al. (2020) also discovered that a negative correlation exists between financial contentment and FRT. Therefore, it is proposed that:

H4: Financial Satisfaction is Significantly Related to FRT

Based on the findings of the previous research, FRT is conceptualised as the extent to which it may enhance or diminish the association between financial environmental factors and FRT. In regard to this, the current study tries to evaluate the effect of financial environmental variables on the level of risk tolerance exhibited by individual investors.

RESEARCH MODEL

The current study derived its model from a multitude of studies and theoretical foundations. This study has conceptualised the research model using existing literature. Fig. 1 depicts the proposed research model for the study. The proposed relationships were examined using structural equation modelling.



Source: Author's compilation.

Fig. 1: Proposed Research Model

STATEMENT OF THE PROBLEM

Investing choices are impacted by a myriad of factors, including psychology, physiology, economics, finance, and interpersonal relationships, throughout the normal course of life. The validity of traditional concepts in finance, such as efficient markets, portfolio theory, and the risk-return trade-off, has been called into serious doubt as a result of research conducted in the field of behavioural finance. The financial market in India has been subjected to a number of fundamental shifts over the course of the previous three decades. The community of investors now has access to a large number and varied selection of investment opportunities. The number of people who engage in retail investing has dramatically increased over the past several years due to the expansion of the range of investment opportunities. The retail investors have access to a variety of investment opportunities, each of which corresponds to a certain degree of FRT. This interest is driven by the desire to provide clients with optimal investment options. According to Grable and Joo (1999), it is possible to determine an investor's level of familiarity with financial risk by doing a comprehensive investigation of the investor's socio-demographic data, as well as their financial and economic environmental factors.

When seen from the perspective of investment advisors and consultants, the evaluation of financial risk tolerance of investors should be the first and most significant step in the process of constructing an investment portfolio for a customer. An investment consultant will make decisions on the asset allocation and diversification of a client's portfolio after conducting an analysis of the client's capacity for risk mentality (Nugyen, 2016). In the context of providing financial advisory services, an assessment of customers' risk-taking ability should be conducted in accordance with their psychological mindset and environmental elements. The primary purpose of this type of evaluation is to gain an

understanding of how investors perceive the risks associated with the market and to give them with practical financial advice that is tailored to their needs (Gibson et al., 2013).

A review of previous research reveals that the evaluation of FRT is influenced by a great number of financial environmental variables. The emphasis of this study is limited to four financial environmental aspects that appear to be prevalent in the process of making financial decisions. The findings of previous studies provide credence to the hypothesis that financial environmental elements have only a significant bearing on investment choices. Fundamentally, each investor is impacted by various financial environmental factors. As a direct consequence of this, many investors make a variety of distinct investment choices. The purpose of this study was to provide new knowledge to the body of existing research by examining the effect of four financial environmental factors on the level of individual investors' tolerance for financial risk. A number of research questions were developed on the basis of the research gaps. These questions provide guidance to researchers so that they may carry out their study in the appropriate manner and reduce the likelihood of deviating from their intended objectives. More specifically, the following research questions may address:

- To what extent the individual investors have risk tolerance while making investment decisions?
- What are the important financial environmental factors affecting the risk tolerance of individual investors?
- Do financial environmental factors have any effect on the amount of risk tolerance?

OBJECTIVES OF THE STUDY

This research focusses on analysing the impact of financial environmental factors on financial risk tolerance. Based on the information identified from the existing literature, the following objectives are identified:

- To measure the level of financial risk tolerance that an investor is willing to accept while making financial

decisions.

- To identify the various financial environmental factors which affecting financial risk tolerance.
- To examine the relationship between identified financial environmental factors and financial risk tolerance.

RESEARCH METHODOLOGY

The primary objective of this research was to evaluate the linkage that exists between financial risk acceptance and several aspects of their financial environment, including financial anxiety, money ethics, financial stress, and financial satisfaction. A single cross-sectional survey design was used in this investigation. A predesigned questionnaire was used to obtain data from retail investors in Kerala, India. The study was performed online in April and May of 2023. To guarantee that the target population was representative, the convenience sampling approach was used. The survey was sent to 400 individual investors; 362 questionnaires were evaluated, and 38 questionnaires were discarded because they were incomplete.

This study looks at four independent variables, such financial anxiety, money ethics, financial stress, and financial satisfaction as well as one dependent variable, the level of financial risk tolerance of individual investors. There were two parts to the survey form, which was designed to collect research data. In the first section, financial risk tolerance was measured by using a 5-item scale developed by Grable and Joo (2004) which as was adapted from Maccrimmon and Wehrung (1986). Respondents were asked to pick the options that best described their risk tolerance level on a 5-point scale. Cronbach’s alpha coefficient was employed in this study to measure the reliability of the FRT scale. The FRT scale has an alpha value of 0.751. In the second section, financial environmental factors were measured. The researcher identified and utilised the Likert Scale which is also known as summated scale for measuring the collected data. The scale used for measuring variables are given in following Table 1.

Table 1: Variables and Scales

Variable	Scale
Financial risk tolerance	FRT scale developed by Maccrimmon and Wehrung (1986)
Financial anxiety	Financial anxiety scale developed by Archuleta et al. (2013)
Money ethics	Money ethics scale developed by Tang (1995)
Financial stress	APR financial stress scale developed by Heo et al. (2020)

Financial satisfaction	Financial satisfaction scale developed by Hira and Mugenda (1998)
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Source: Author’s compilation.

ANALYSIS AND DISCUSSION

The purpose of this study was to investigate the relationship between financial environmental factors and the risk tolerance level of individual investors. This research is intended to contribute to the existing literature on behavioural finance. The effect of financial environmental variables on the FRT is an issue of the study that is now being conducted. In order to do this, the information gathered from the 362 retail investors who participated in the survey was analysed so that the hypotheses of the present investigation could be evaluated. Structural Equation Modelling was carried out to find the influence of financial environmental factors on financial risk tolerance.

Table 2: Financial Risk Tolerance

Items	Mean	SD
“Investing is too difficult to understand”	2.56	0.98
“I am more comfortable putting my money in a bank account than in the stock market”	2.88	0.94
“When I think of the word ‘risk’ the term ‘loss’ come to mind immediately”	3.08	0.91
“Making money in stocks and bonds is based on luck”	3.24	0.87
“In terms of investing, safety is more important than returns”	3.46	0.86
Average summated score	3.04	0.91

Source: Primary data.

The descriptive statistics are displayed in Table 2, which also provides the average summated score of the FRT as well as the score summed up for each individual item. The standard deviation of the total summated score on the FRT is 0.91, with the average score being 3.04. The score gives an indication of the level of the FRT. Scores that are higher reflect a more rapid FRT.

Table 3: Financial Anxiety

Items	Mean	SD
“I feel anxious about my financial situation”	3.12	0.89
“I have difficulty sleeping because of my financial situation”	2.97	0.95
“I have difficulty concentrating on my work because of my financial situation”	2.61	0.92
“I am irritable because of my financial situation”	3.21	0.85
“I have difficulty controlling worrying about my financial situation”	3.11	0.87
“My muscles feel tense because of worries about my financial situation”	2.45	0.98

“I feel fatigued because I worry about my financial situation”	2.33	0.99
Average summated score	2.82	0.92

Source: Primary data.

Table 3 also displays the average summated financial anxiety score as well as the summated scores for each individual item. Financial anxiety averages 2.82 out of a possible 5, with an SD of 0.92. The higher the score indicates higher anxiety about the financial situation.

Table 4: Money Ethics

Items	Mean	SD
“Money is a symbol of success”	3.47	0.81
“Money will help you express your competence and abilities”	3.62	0.79
“Money represents one’s achievement”	3.56	0.81
“I value money very highly”	3.95	0.74
“Money makes people respect you in the community”	3.44	0.79
“Money can give you the opportunity to be what you want to be”	3.52	0.78
“Money gives you autonomy and freedom”	3.88	0.76
“Money is important”	3.21	0.84
“I budget my money very well”	3.46	0.79
“I use my money very carefully”	3.51	0.81
“Money is the root of all evil”	2.91	0.98
“Money is evil”	2.91	0.98
Average summated score	3.45	0.82

Source: Primary data.

Table 4 includes the average summated score for money ethics as well as the summated scores for each item. Money ethics has an average total score of 3.45 and a standard deviation of 0.82. The score reflects the intensity of the money ethics. The higher the score indicates the Individual have higher morality on money matters.

Table 5: Financial Stress

Items	Mean	SD
Affective Reaction (AR)		
“I feel depressed because of my financial situation”	2.89	0.95
“I feel sad because of my financial situation”	2.78	0.98
“I am fearful because of my financial situation”	2.99	0.91

“I feel anxious because of my financial situation”	3.01	0.84
“I worry a lot because of my financial situation.”	3.25	0.82
Relational/ Interpersonal Behaviour (RB)		
“My financial situation interferes with my daily job performance”	2.77	0.96
Items	Mean	SD
“I frequently pass on social events at work due to my financial situation”	3.11	0.84
“I often get into trouble at work because of my financial situation”	2.99	0.91
“My financial situation frequently interferes with my relationship with co-workers/colleagues”	3.42	0.79
“I often argue with my spouse/significant other because of financial matters”	3.47	0.81
Physiological Responses (PR)		
“I have stomach aches frequently because of my financial situation”	2.66	0.89
“My heartbeat increases because of my financial situation”	2.98	0.92
“I feel cold because of my financial situation”	2.14	0.99
“I have more sweat because of my financial situation”	2.52	0.96
“I am sensitive to noise because of my financial situation”	2.89	0.95
Average summated score	2.92	0.90

Source: Primary data.

Table 5 displays both the average summated score of financial stress as well as the scores compiled for each individual question in the test of financial stress. The standard deviation of a person’s financial stress score is 0.90, with the mean total score of financial stress coming in at 2.92. The score represents the respondent’s level of financial stress. The higher score indicates a higher level of financial stress.

Table 6: Financial Satisfaction

Items	Mean	SD
“I am satisfied with regular monetary savings”	3.24	0.87
“I am satisfied with current debt level”	3.32	0.85
“I am satisfied with family’s current financial situation”	3.42	0.89
“I am satisfied with ability to meet long-term financial goals”	2.98	0.92
“I am satisfied with ability to meet financial emergencies”	2.86	0.98
“I am satisfied with money management skills”	3.01	0.91
Average summated score	3.13	0.90

Source: Primary data.

Table 6 presents the summated score of each item, along with the average summated score of financial satisfaction. The mean summated score of financial satisfaction is 3.13, accompanied by a standard deviation of 0.90. The score serves as an indicator of the degree of financial satisfaction. A higher score is indicative of a greater degree of financial satisfaction.

The indication of composite reliability as well as Cronbach’s alpha were utilised so that the dependability of the present data could be evaluated together with its internal consistency. According to Saunders et al. (2007), reliability may be defined as an estimation of how consistent the outcomes are dependent on that data collection and processing approach. It is recommended that the values of composite reliability be more than 0.70 for each and every one of a measurement model construct (Nunnally, 1978). As a consequence of this, the number that was arrived at for the composite reliability of the study constructs falls somewhere in the range of 0.792 and 0.854 (Table 7).

Although the range of the Cronbach’s alpha coefficient is

from 0 to 1, and a value of at least 0.70 is considered to be indicative of strong internal reliability (Nunnally, 1978). As a result, the value of Cronbach’s alpha that was found in the research falls somewhere between 0.751 and 0.825 (Table 7). The reliability score of variables exceeds 0.751, which exceeds the minimum standard value for a variable. Therefore, all constructs have a high degree of reliability which is presented in Table 7. Likewise, calculating the Average Variance Extracted (AVE) value confirmed that all variables possess convergent validity. In general, constructs with an AVE greater than 0.50 (Hair & Black, 2006) are regarded to have acceptable convergent validity. The AVE of all variables is greater than 0.5, indicating that these variables explain more than 50% of the variation.

The components of the model have each been scrutinised to see the extent to which they may be said to reflect the same factor. In order to construct validity, it is necessary to evaluate dimensionality, dependability, and both convergent and discriminant validity. It can be also found from Table 7, all the constructs have good discriminant validity, which was tested by measuring the square root of the AVE that exceeds the inter-correlation of the construct with the other constructs or the squared correlation between the constructs,

which should be less than the AVE (Hair & Black, 2006). As a result, the measurement model was found to be sufficient with the support of adequate construct reliability and validity.

Table 7: Reliability and Validity

Variable	No. of Items	Alpha Value	Composite Reliability	AVE	√AVE
Financial risk tolerance (FRT)	5	0.751	0.792	0.571	0.755
Financial anxiety (FEFFA)	7	0.762	0.812	0.574	0.757
Money ethics (FEFME)	12	0.825	0.854	0.596	0.772

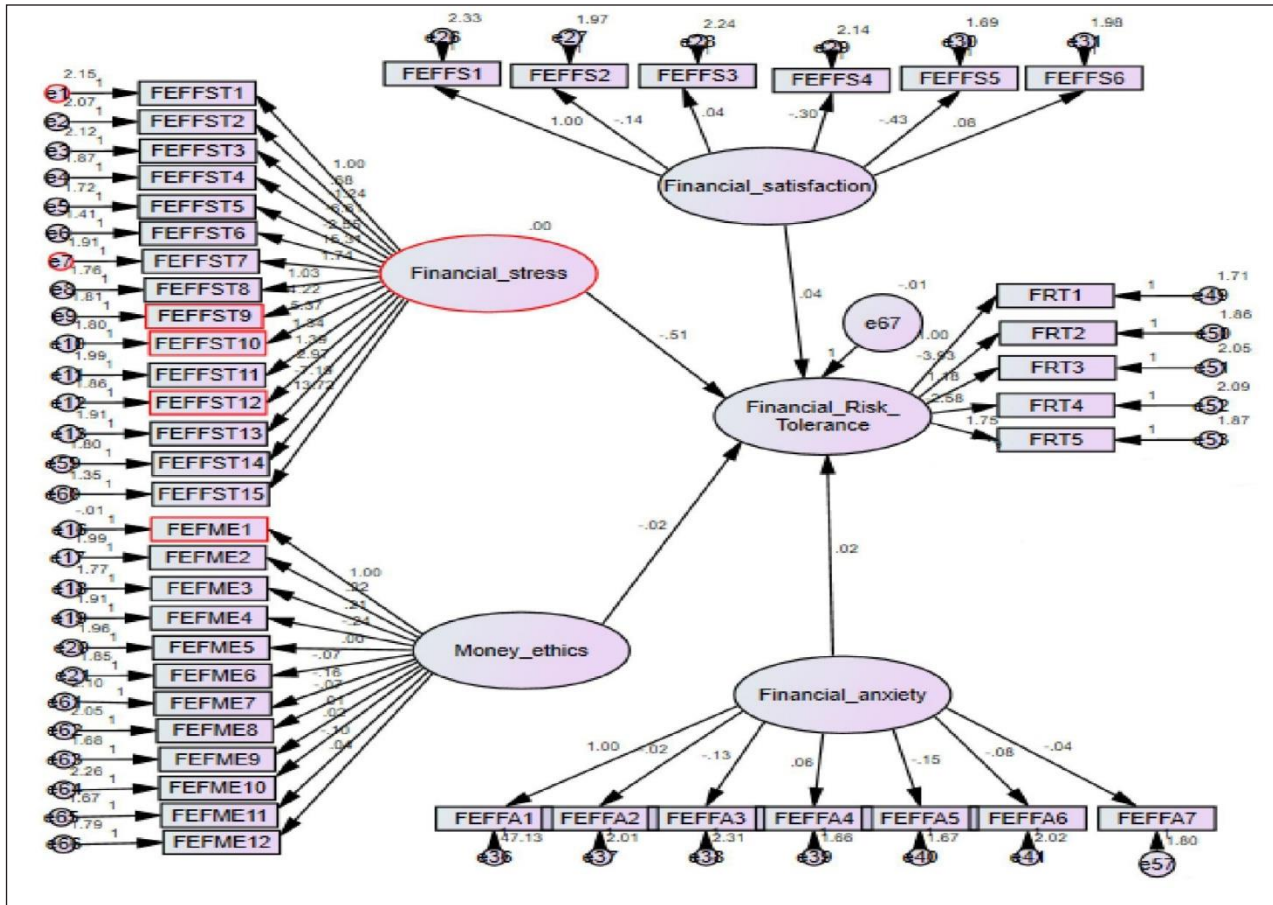
ST)	15	0.798	0.822
(FEFFS)	6	0.801	0.834

Source: Primary data.

The present investigation focused on examining the influence of financial environmental variables on financial risk tolerance (FRT). In order to test the hypotheses of the present study, a structural equation modelling (SEM) analysis was conducted. Discovering and assessing the

links between observable and latent variables may be accomplished through the use of a statistical method called structural equation modelling (SEM). Structural equation modelling, often known as SEM, is a powerful multivariate analytic technique that is finding growing application in the scientific community for examining potential associations between multiple variables (Fan et al., 2016). It is comparable to, but substantially more powerful than, regression analysis since it analyses linear

causal links between variables while also taking into account measurement error (Beran & Violato, 2010). Fig. 2 depicts a picture of a structural equation model (SEM) captured from the AMOS software.



Source: Primary data.

Fig. 2: Result of Structural Model

The importance of the study is to assess and define the impact of financial environmental factors such as financial anxiety,

money ethics, financial stress, and financial satisfaction on financial risk tolerance in a different context than previous studies. According to the present research findings, the four hypotheses in the study model are accepted.

Table 8: Structural Model Assessment

Hypothesis	Relationship	T-Value	P-Value	Decision
H1	FEFFA FRT	6.214	0.001*	Accepted
H2	FEFME FRT	4.474	0.000*	Accepted
H3	FEFFST FRT	3.237	0.001*	Accepted
H4	FEFFS FRT	3.481	0.000*	Accepted

Source: Primary data, *Significant at 0.01 level.

The findings obtained from the structural equation modelling (SEM) analysis indicate that financial environmental factors exert a statistically significant influence on FRT. The p-value of less than 0.01 shows that the results are significant and that these four factors can explain a large percentage of the variance in financial risk tolerance (Table 8). Regarding the initial hypothesis of the present study (i.e., financial anxiety is significantly related to FRT), the data obtained from retail investors in Kerala demonstrated a statistically significant association between financial anxiety and FRT. It has been found that the financial anxiety determines the FRT of investors, specifically investors with lower levels of financial anxiety tend to exhibit a higher FRT, whereas investors with higher levels of financial anxiety are more inclined to have a lower FRT. The second hypothesis proposed in the present study was “money ethics is significantly related to financial risk tolerance”. This hypothesis has been

supported by the findings, which indicate that investors with higher money ethics tend to engage in risky situations and financial decisions, resulting in higher levels of financial risk tolerance compared to investors without such behaviour. The third hypothesis of the present study was “financial stress is significantly related to financial risk tolerance”. Based on the present findings, the researcher has accepted the hypothesis due to the revealed results indicating association between financial stress and investor engagement in high-risk financial situations which means lower financial stress to leads higher financial risk-taking attitude. The fourth hypothesis of the current study as “financial satisfaction is significantly related to financial risk tolerance”. The results empirically observed that financial satisfaction is positively related to financial risk tolerance. More specifically, it revealed that a person with high financial satisfaction is more likely to take risky financial decisions.

Table 9: Measurement Model Fit

Indicators	Observed Value	Standard Value	Model Fit
CMIN/DF	3.637	> 5 (Wheaton et al., 1977)	Acceptable
GFI	0.847	> 0.80 (Byrne, 2010)	Acceptable
CFI	0.919	> 0.90 (Byrne, 2010)	Acceptable
IFI	0.932	> 0.90 (Bollen, 1989)	Acceptable
RMSEA	0.074	< 0.08 (Hair et al., 2006)	Acceptable

Source: Primary data.

To check the model fitness of the current model containing financial anxiety, money ethics, financial stress, and financial satisfaction, the Confirmatory Factor Analysis (CFA) was carried out on the data collected through which the results given in Table 9 were found. Several research papers have also emphasised the most generally reported fit indices, which are the CMIN-DF, GFI, CFI, IFI, and RMSEA (Naqvi et al., 2020; Marsh et al., 2014). These are the indices that are typically employed for reporting the model fitness. As an outcome of this, it was decided to provide the following goodness of fit indices: CMIN-DF, GFI, CFI, IFI, and RMSEA for the purpose of evaluating the research model using CFA and SEM. The results of model fitness indicate that value of CMIN/DF is 3.637 (i.e., <5), Goodness of Fit Index (GFI) is 0.847 (i.e., >0.80), Comparative Fit Index (CFI) is 0.919 (i.e., >0.90), Incremental Fit Index (IFI) is 0.932 (i.e., >0.90), and the Root Mean Square Error of Approximation (RMSEA) is less than 0.08. It means that resulting values of all indicators are falling within the threshold range so, the current model is a good fit.

CONCLUSION

The primary objective of this study was to examine the influence of financial environmental indicators on financial

risk tolerance. The present study was carried out in the state of Kerala, India, wherein data were gathered from retail investors through a questionnaire. The study contributes to the field in three different ways. First, it determines how much one is willing to take on in terms of financial risk. Second, it assesses the degree to which financial environmental variables influence financial risk tolerance, and third, it evaluates the impact that financial environmental factors have on financial risk tolerance. This research added to our knowledge of risk tolerance by providing academics, researchers, and financial planners with a new viewpoint on how to use financial environmental variables that are vital in financial markets.

The utilisation of Structural Equation Modelling (SEM) on the dataset has demonstrated that all of the hypotheses proposed in this research have been confirmed. Research has revealed that financial anxiety, money ethics, financial stress, and financial satisfaction exert notable influences on FRT. Investors that have a high-risk tolerance are ready to take the chance of losing money on an investment if they believe the opportunity for a larger reward would more than make up for the loss. If investors have a fear of taking risks, they may strive to limit their exposure to such risks as much as possible by investing their money in assets with a very low chance of loss. The level of risk that an investor is

willing to take should determine the type of investment that they select.

The inaccurate assessment of the Financial Risk Tolerance (FRT) has the potential to result in the selection of inappropriate investment alternatives. Consequently, this may lead to a decrease in the financial resources and overall well-being of investors. Financial service providers may face negative consequences when clients make poor investment decisions, such as selling a profitable investment or allocating funds to an inappropriate portfolio. The present study is anticipated to make a significant scholarly and practical contribution as it will introduce novel avenues for discourse and examination among researchers specialising in FRT, financial decision-making, and financial satisfaction. The theory pertaining to financial decision-making and financial risk tolerance will be further developed. The present study aims to provide practical insights for retail investors by examining the relationship between financial anxiety, money ethics, financial stress, financial satisfaction, and financial risk tolerance. The findings of this study will assist retail investors in understanding how these financial environmental factors can influence their FRT. The results provided by the present study may provide significant support to state and national policy makers in formulating investment policies.

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DOES INDIAN ADR STOCKS UNCERTAINTY SHOCK PLAY IMPORTANT ROLES IN THE MOBILITY OF US STOCK MARKET?

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Abstract *The study focuses on the selection of Indian ADR (American depository receipts) equities for the mobility of the US stock market, which are listed on the US stock exchange. This study evaluated the dynamic link between Indian ADR and the US stock market utilising VAR Granger Causality/Block Exogeneity Wald Tests, followed by variance decomposition and impulse response. The NYSE (New York Stock Exchange) is used as a proxy variable for the US stock market. The research gathered data with the goal of having a data range of twenty years. The data range of less than twenty years was excluded from the investigation, and the study was completed with seven Indian ADR variables out of fourteen Indian ADR variables. Daily time-series data for seven Indian ADR variables listed in the US market have been gathered from 2001 to 2021. The result verifies that NYSE is caused by WIT (Wipro Limited), HDB (HDFC Bank Limited), and SIFY (Sify Technologies Limited), and it confirms that NYSE is also causing RDY (Dr. Reddy's Laboratories Limited) and SIFY, respectively. As a result, the bivariate causation between SIFY and NYSE is confirmed SIFY is the Indian ADR that is contributing to the NYSE's mobility among all Indian ADRs listed on the foreign stock exchange. IBN (ICICI Bank Ltd.) and WIT are contributing to the variance decomposition of NYSE, and this is a highly significant variation in NYSE when compared to other variables. The SIFY's asymmetric influence on the NYSE is represented by the impulse response function.*

Keywords: *Indian ADR, NYSE, VAR Granger Causality/Block Exogeneity Wald Tests, Variance Decomposition, Impulse Response, American Depository Receipt*

JEL Classification: *G15, G17*

INTRODUCTION

An ADR is a commodity offered by US registered monetary institution to national investors like a replacement for the immediate possession of foreign company shares. An ADR can symbolise one or more stocks of a non-US company, or a proportion of a stock (Bhatiya, 2014). Throughout the last 2 decades, as businesses in emerging nations have cultivated a more holistic view, ADR have become ubiquitous means for international corporations to obtain money. The earnings on ADRs are totally reliant on underpinning equity as well as foreign fluctuations, further they trade close to parity with their local counterparts (Gupta, 2010). (Madhavan & Ray, 2016) ADRs are negotiable securities offered by non-U.S. corporations as well as traded on US stock exchanges, providing an opportunity for worldwide exposure for American buyers. Rule 144 A, Level-I, II, and

III are various forms of ADR accessible on the market. The currency trading volume of ADRs increased by 36 percent on an annualised rate between 1997-98, as per New York Bank, main depository of ADRs in the United States. At the same time, the New York Stock Exchange (NYSE) dollar trading volume (except ADRs) increased by 32 percent. Arbitrage activity in Indian ADRs is regulated by the Indian government. ADRs can be redeemed for underlying shares, but they can only be created from underlying shares in the primary market with approval from the Indian government granted to the corporation. According to (Kadapakkam & Misra, 2003), premiums on Indian ADRs cannot be arbitrated away in secondary markets. American depository receipts (ADRs) continue to be the major methods utilised by businesses in emerging economies to list internationally. However, there is a dearth of research in emerging markets regarding the aftermath performance of ADR issuances.

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(Adami et al., 2023) analysed how operating performance of the firms changed after ADR issuances and the findings indicate that ADRs have comparatively superior short-term purchasees and hold abnormal returns and they eventually produce positive abnormal returns. (Wadhwa, 2015) examined the impact of trading behaviour by foreign portfolio investors on the Indian stock markets and proposed that appropriate foreign investment policies for the Indian stock markets should be designed and overseen by the government and economists. (Khalid & Habib, 2016) examined how different macroeconomic factors affect the Indian stock market and found that stock returns are significantly impacted negatively solely by exchange rates while money supply, inflation, industrial production, interest rates, and oil prices have a big influence on the stock market. (Samet et al., 2023) discovered that institutional investors make larger investments in standalone ADRs, or ADRs without underlying stocks listed in the home market. The volume of ADR transactions in 1998 was \$563 Billion¹. According to (Bin et al., 2003), ADR yields are susceptible to fluctuations in (a) the US trade, (b) the underpinning home stock markets, as well as (c) the equivalent foreign exchange market. Similarly, we incorporated equivalent elements into our adaptive structural model. Using monthly data, (Rohilla et al., 2023) examined the long-term relationship between investor sentiment and the volatility of the Indian stock market from 2010 to 2021 and determined that, over time, volatility is negative when sentiment is positive and vice versa. (Lins & Strickland, 2000) discovered that having accessibility to global financial markets is a substantial advantage of a US stock market listing, particularly for developing market companies. Most of the ADR research suggests that pairing ADRs with the US market or additional assets can minimise risk while maintaining projected benefits (Officier & Hoffmeister, 1987; Wahab & Khandwala, 1993).

The current paper focuses on the selection of Indian ADR (American depository receipts) equities for the mobility of the US stock market, which are listed on the US stock exchange. This study evaluated the dynamic link between Indian ADR and the US stock market utilising VAR Granger Causality/Block Exogeneity Wald Tests, followed by variance decomposition and impulse response.

LITERATURE REVIEW

Numerous research has been conducted on ADRs and US stock market along with the Indian stock market. (Choi & Kim, 2000) investigated ADRs from 1990 to 1996 and found that they can be advantageous in a person's portfolio

for diversification of risk, with developing markets, ADRs providing the optimum opportunity. (Kim et al., 2000) use the VECM to scrutinise static price links among the price of an American Depository Receipt and the price of an underlying stock. (Alaganar & Bhar, 2001) explored whether arbitrage possibilities exist amongst ADRs and their underlying equities in established marketplace, whereas (Rabinovitch et al., 2003) consider the problem in developing economies. (Arnold et al., 2002) surveyed regarding the variability of ADRs in conditions of trade in United States, trade in its native territories, as well as the variability in the rate of exchange amid the United States with ADRs' home country. Their findings showed that the standard deviation (σ) of profit of ADRs is non considerably divergent as of standard deviation of return of its underlying native nation's equities. (Gorman et al., 2004) contrast the ex-dividend day investment gains coupled with trade velocity of external equities traded as ADRs in U.S. stock markets to ex-day yields in addition to the quantity of paired sample of U.S. equities. Researchers enable us to see if changes in payment of dividend methods and/or foreign money risk have an impact on ADRs equity returns and trade velocity on ex-dividend day. (Chung et al., 2007) to explore the dynamic price connection among both ADRs and their underlying equities use the criterion VECM in research. (Chen et al., 2011) investigated whether American Depository Receipts (ADRs) have a detrimental impact on the underlying local index (LD) for the Japanese market.

(Kabir et al., 2011) determined if ADRs may provide diversified advantages to U.S. investors beyond what can be obtained by buying directly in nation indexes. Their data demonstrate that ADRs and country indexes were interchangeable in the industrialised world in the late 1990s, but traders needed to finance both ADRs as well as country indexes in Latin America and just ADRs in Asia in recent years. (Kumar et al., 2011) investigated the impact of global competition for order flows on the local market as a result of six Indian enterprises registering American Depository Receipts (ADRs) on the NYSE. The study (Visalakshmi & Lakshmi, 2013) showed that the values of Indian ADRs and their underlying securities, as well as the Indian and U.S. market indexes, have a long run cointegrating connection. The divergence from long-run equilibration and lagged variations of all, impact the ADR portfolio's short-term fluctuations. (Wang et al., 2013) examined how trading location influences the equity returns of China-backed American Depository Receipts (ADRs) traded in the US. If International Financial Markets are interconnected, stock prices should be influenced only by fundamentals; otherwise, stock prices may be influenced by trading locations and investor emotion. According to the report, China ADR results are influenced more by US market volatility than by Chinese market returns. (Wu, 2013) detected a positive holiday effect

¹Data on trading volume is obtained from the ADR segment of the Bank of New York's website. Retrieved from <http://www.bankofny.com:adr>

during the CNY (Chinese National Holidays) season using all Chinese ADRs completed from 1993-2011, however, this influence becomes statistically negligible when adjusted or modified for US returns. Conversely, Chinese ADRs had much greater mean returns in the week leading up to the festival than in the remaining year, but lower mean returns in the week after holiday. From a non-linear univariate aspect (Madhavan & Ray, 2016) assessed at the effectiveness of level II/III Indian ADRs and its underlying equities operating in Mumbai (Maharashtra). The findings show that the measure of effectiveness of all U.S./Indian securities studied in the study is varied, necessitating a grading mechanism in each trading platform. (Tripathi & Kumar, 2014) in order to analyse the issue of sectoral efficiency of the Indian stock market, the following tests are used: variance ratio test, unit root tests, Phillips-Perron (PP), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS). The overall performance of the Indian stock market appears to be lackluster, but several sectors within it have performed well, particularly over the course of the study period. (Bhatnagar & Khan, 2015) examined the impact of global currency value on the monthly yield on ADR from 2004 to 2013 and found that Forex earnings have a substantial relationship with ADR returns, but the ADR returns are not a major predictor of Forex returns. (Gupta et al., 2016) examined that oil prices and economic growth lead ADR prices in the near run, but ADR prices foretell changes in the money supply in India. The same demonstrate that in the long-run, economic development boosts ADR returns favourably in Brazil and China but adversely in Russia and India.

According to the experimental findings, the equity market in the United States is more competitive than the capital market in India. The effectiveness of all ADRs, its underlying stocks, and now both countries' market has varied (Singh & Chakraborty, 2017). Although, compared to their underlying equities, variation in efficacy of Indian ADRs is greater, implying that a stock listed on stock indexes from various nations may exhibit varying rates of efficiency development depending upon market maturity. (Li et al., 2019) looked at foreign companies' decisions to list on ADRs exchanges in the United States. ADR firms listed in hot years do much worse in terms of operating and stock performance than those listed in cold years. Foreign companies reveal more information than comparable U.S. companies, according to (Chowdhary et al., 2021), notably in the social and the environment Corporate Social Responsibility (CSR) components. Additionally, they discovered conclusive proof, as a result of foreign firms' greater CSR revelation, overseas equities have lower idiosyncratic volatility, better liquidity, and higher institutional ownership than other comparable U.S. stocks. Domestic liquidity for both established and emerging market enterprises dramatically rises after a US cross listing, according to research by (Ghaffar et al., 2022).

The preventive, primary, transitional, and extensive impacts on domestic liquidity are all noticeably favourable for businesses in emerging economies.

According to (Kumar, 2023), premiums are adversely correlated with underlying stock returns while Indian ADR returns are closely linked to underlying market returns. This analysis demonstrates that Indian ADR premiums are considerably and favorably related to investor to buy demand using an order imbalance of small and total trades of ADRs. (Aharon et al., 2022) studied the effect of Robinhood investors' activity on the volatility of 382 American depository receipts (ADRs) from 33 different nations revealed that their participation increases the volatility of cross-listed securities. They claimed that their findings had significant ramifications for various market and government policy makers as well as domestic companies thinking about cross listing their equities. Another study, by (Aharon et al., 2022), looked at the effect of COVID-19 related government involvement on the liquidity and volatility of 387 ADRs from 34 different countries and found the closures, limitations, and restraint health measures put in place during the pandemic's outbreak period appeared to worsen the ADRs' liquidity and stability. (Grossmann et al., 2024) to investigate the relationship between societal secrecy and IPO underpricing, a study that looks at 350 Level III ADR IPOs from thirty-five countries between 1990 and 2020 discovered that ADR IPO underpricing is lower for ADRs from high secrecy nations.

RESEARCH METHODOLOGY

The dynamic relationship between Indian ADR and the underlying stock is well known in the Indian stock market. The ADR stands for American Depository Receipt, which allows Indian equities to be traded on American stock exchanges. Several research on Depository Receipts (DRs) have found that trading on the DR in the foreign market has an impact on the stock, price, volatility, and volume in the home country. Similarly, will Indian ADRs are influencing the US stock market and do they have the dynamic relationship. This is the strong reason to conduct this research. The research is going to help various groups and individuals who are interested in the equity research and interested in the foreign investment. The study period is from July 2001 to April 2021. The dataset is on a daily basis. The data is collected from the yahoo finance website. Firstly, we have taken the 14-variable dataset of Indian ADR listed in US market, but we have drop down the 7 Indian ADR variables due to the limited time series dataset. We have taken twenty years as a base to collect the data. Finally, we have chosen seven Indian ADR variables to test the US market mobility. The proxy variable for US market is NYSE. The model will take into account Indian ADR's greater and

more significant contribution to the US stock market in terms of price, volume, and volatility. For improved time series analysis results, all the variables used in the study are transformed to the logged version.

Model Specification

The VAR model equation is written for every variable,

which is explaining the dynamic relationship with its own lag variable and the other equation model variables. The VAR system is employed to investigate the dynamic relationship, which is, exist between the series variables. The VAR model system is also going to check the impact of random disturbance on the variables of the system (Table 1). The VAR model is as follows:

$$Y_t = A_1 Y_{t-1} + \dots + A_p Y_{t-p} + B X_t + e_t$$

Table 1

Description of Variables	NYSE	New York Stock Exchange
	HDB	HDFC Bank Limited
	IBN	ICICI Bank Limited
	INFY	Infosys Limited
	RDY	Dr. Reddy’s Laboratories Limited
	REDFY	Rediff.com India Limited
	SIFY	Sify Technologies Limited
	WIT	Wipro Limited

The process of VAR model equations is written as follows:

$$D(LN_NYSE)_t = \alpha_1 + \beta_{11}D(LN_IBN)_{t-1} + \beta_{12}D(LN_WIT)_{t-1} + \beta_{13}D(LN_RDY)_{t-1} + \beta_{14}D(LN_INFY)_{t-1} + \beta_{15}D(LN_NYSE)_{t-1} + \beta_{16}D(LN_HDB)_{t-1} + \beta_{17}D(LN_SIFY)_{t-1} + \beta_{18}D(LN_REDFY)_{t-1} + \epsilon_t \quad (\text{Equation 1})$$

$$D(LN_IBN)_t = \alpha_2 + \beta_{21}D(LN_IBN)_{t-1} + \beta_{22}D(LN_WIT)_{t-1} + \beta_{23}D(LN_RDY)_{t-1} + \beta_{24}D(LN_INFY)_{t-1} + \beta_{25}D(LN_NYSE)_{t-1} + \beta_{26}D(LN_HDB)_{t-1} + \beta_{27}D(LN_SIFY)_{t-1} + \beta_{28}D(LN_REDFY)_{t-1} + \epsilon_t \quad (\text{Equation 2})$$

$$D(LN_WIT)_t = \alpha_3 + \beta_{31}D(LN_IBN)_{t-1} + \beta_{32}D(LN_WIT)_{t-1} + \beta_{33}D(LN_RDY)_{t-1} + \beta_{34}D(LN_INFY)_{t-1} + \beta_{35}D(LN_NYSE)_{t-1} + \beta_{36}D(LN_HDB)_{t-1} + \beta_{37}D(LN_SIFY)_{t-1} + \beta_{38}D(LN_REDFY)_{t-1} + \epsilon_t \quad (\text{Equation 3})$$

$$D(LN_RDY)_t = \alpha_4 + \beta_{41}D(LN_IBN)_{t-1} + \beta_{42}D(LN_WIT)_{t-1} + \beta_{43}D(LN_RDY)_{t-1} + \beta_{44}D(LN_INFY)_{t-1} + \beta_{45}D(LN_NYSE)_{t-1} + \beta_{46}D(LN_HDB)_{t-1} + \beta_{47}D(LN_SIFY)_{t-1} + \beta_{48}D(LN_REDFY)_{t-1} + \epsilon_t \quad (\text{Equation 4})$$

$$D(LN_INFY)_t = \alpha_5 + \beta_{51}D(LN_IBN)_{t-1} + \beta_{52}D(LN_WIT)_{t-1} + \beta_{53}D(LN_RDY)_{t-1} + \beta_{54}D(LN_INFY)_{t-1} + \beta_{55}D(LN_NYSE)_{t-1} + \beta_{56}D(LN_HDB)_{t-1} + \beta_{57}D(LN_SIFY)_{t-1} + \beta_{58}D(LN_REDFY)_{t-1} + \epsilon_t \quad (\text{Equation 5})$$

$$D(LN_HDB)_t = \alpha_6 + \beta_{61}D(LN_IBN)_{t-1} + \beta_{62}D(LN_WIT)_{t-1} + \beta_{63}D(LN_RDY)_{t-1} + \beta_{64}D(LN_INFY)_{t-1} + \beta_{65}D(LN_NYSE)_{t-1} + \beta_{66}D(LN_HDB)_{t-1} + \beta_{67}D(LN_SIFY)_{t-1} + \beta_{68}D(LN_REDFY)_{t-1} + \epsilon_t \quad (\text{Equation 6})$$

$$D(LN_SIFY)_t = \alpha_7 + \beta_{71}D(LN_IBN)_{t-1} + \beta_{72}D(LN_WIT)_{t-1} + \beta_{73}D(LN_RDY)_{t-1} + \beta_{74}D(LN_INFY)_{t-1} + \beta_{75}D(LN_NYSE)_{t-1} + \beta_{76}D(LN_HDB)_{t-1} + \beta_{77}D(LN_SIFY)_{t-1} + \beta_{78}D(LN_REDFY)_{t-1} + \epsilon_t \quad (\text{Equation 7})$$

$$D(LN_REDFY)_t = \alpha_8 + \beta_{81}D(LN_IBN)_{t-1} + \beta_{82}D(LN_WIT)_{t-1} + \beta_{83}D(LN_RDY)_{t-1} + \beta_{84}D(LN_INFY)_{t-1} + \beta_{85}D(LN_NYSE)_{t-1} + \beta_{86}D(LN_HDB)_{t-1} + \beta_{87}D(LN_SIFY)_{t-1} + \beta_{88}D(LN_REDFY)_{t-1} + \epsilon_t \quad (\text{Equation 8})$$

Unit Root Analysis

The majority of financial time series are non-stationary time series or random walks with unit root in their original form, based on the current literary work. As a result, before using any econometric method, we checked for the presence of a unit root in the selected time series variables. We conducted the investigation to determine the dynamic connections between the series. A unit root existence in the chosen series can lead to erroneous conclusions in the analysis. The time series data stationarity is determined by applying the ADF test. At level, the time series data is non-stationary. Therefore, we have adopted the first difference to make the data stationary. Data become stationary at first difference (see Table 2).

The response of ADF test has allowed us to test the VAR approach among the eight variables to test the causality. All the specified time series are assumed to be endogenous

To estimate the optimum lag value, we have applied the VAR lag exclusion Wald tests to obtain the right lag length. The result of the VAR lag exclusion Wald tests suggested us the six-lag length. We can see in the above result (Table 3) that up to six joint lag lengths the value is declining and after that it has an increasing and decreasing sequence. It means that we cannot reject it up to the six-lag length. In lag 1, all variable values are showing significant results followed by lag 2 is five significant values, lag 3 is five significant values, lag 4 are four significant values, lag 5 with two significant values, and lag 6 with four significant values.

We hypothesised that if one variable in a time series is “Granger Causes” to the other time series variables, the coefficient of the lagged values of the former time series must be significant because the VAR technique evaluates many variables at once. However, to investigate multivariate causation in a VAR technique, we needed to determine the appropriate number of lags. The following indicators were used to make this decision and after the analyses, the selections of the optimum lag of the eight selected time series, as shown in Table 3.

Finalising the lag length, the next step is to employ the VAR Granger Causality/ Block Exogeneity Wald Test. The result of the test is shown in Table 4. The outcome of the VAR Granger Causality/ Block Exogeneity Wald test revealed the

presence of a significant multivariate causal link within the specified time series NYSE, IBN, WIT, HDB, INFY, RDY, SIFY, and REDFY.

If we see the result, the lagged value of log WIT, log HDB, and log SIFY is significant and affecting the daily value of log NYSE. The log SIFY is highly significant out of the three significant variables. It means that log NYSE is largely caused by the log SIFY Indian ADR as per the result. So here, this represents the highest mobility in the NYSE value. If we see the other results, lagged valued of the log HDB and log SIFY is significant and explaining the changes in the value of log IBN. Similarly, log IBN, log INFY, log HDB causing to log WIT and log IBN, log NYSE, log HDB, log SIFY causing to log RDY and log HDB, log SIFY, log REDFY causing to log INFY and log IBN, log SIFY causing to log HDB and log IBN, log NYSE, log REDFY causing to log SIFY, and log SIFY causing to log REDFY.

The results confirm that log NYSE is caused by the log WIT, log HDB, log SIFY and it is also confirming that log NYSE is causing log RDY and log SIFY. Therefore, it confirms the bivariate causality between log SIFY and log NYSE. Log SIFY is the Indian ADR, which is contributing to the mobility of log NYSE among all the Indian ADR listed in the foreign stock market.

Table 4: VAR Granger Causality/Block Exogeneity Wald Tests

D V : D(ln_IBN)			
Excluded	Chi-sq	Df	Prob.
D(LN_WIT)	7.980732	6	0.2395
D(LN_RDY)	4.628057	6	0.5923
D(LN_INFY)	3.804746	6	0.7031
D(LN_NYSE)	6.192105	6	0.4020
D(LN_HDB)	14.51574	6	0.0244
D(LN_SIFY)	14.83289	6	0.0216
D(LN_REDFY)	5.601641	6	0.4693
All	64.15724	42	0.0154

D V : D(ln_WIT)			
Excluded	Chi-sq	Df	Prob.
D(LN_IBN)	14.50701	6	0.0245
D(LN_RDY)	11.53742	6	0.0731
D(LN_INFY)	33.59868	6	0.0000
D(LN_NYSE)	5.090492	6	0.5323
D(LN_HDB)	19.88208	6	0.0029
D(LN_SIFY)	7.750476	6	0.2570
D(LN_REDFY)	5.465520	6	0.4856
All	102.0913	42	0.0000

D V : D(ln_RDY)			
Excluded	Chi-sq	Df	Prob.
D(LN_IBN)	25.05982	6	0.0003
D(LN_WIT)	7.551019	6	0.2729
D(LN_INFY)	11.22397	6	0.0817
D(LN_NYSE)	19.48342	6	0.0034
D(LN_HDB)	21.12817	6	0.0017
D(LN_SIFY)	18.42382	6	0.0053
D(LN_REDFY)	8.171327	6	0.2258
All	106.4021	42	0.0000

D V : D(ln_HDB)			
Excluded	Chi-sq	Df	Prob.
D(LN_IBN)	28.33285	6	0.0001
D(LN_WIT)	8.837558	6	0.1829
D(LN_RDY)	2.855567	6	0.8267
D(LN_INFY)	6.565448	6	0.3629
D(LN_NYSE)	12.07890	6	0.0602
D(LN_SIFY)	12.82409	6	0.0459
D(LN_REDFY)	2.341908	6	0.8857
All	76.69987	42	0.0009

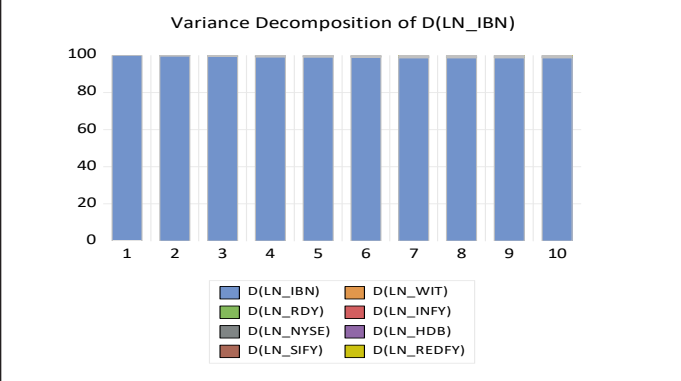
D V : D(ln_INFY)			
Excluded	Chi-sq	Df	Prob.
D(LN_IBN)	8.948238	6	0.1765
D(LN_WIT)	7.732993	6	0.2583
D(LN_RDY)	4.196605	6	0.6501
D(LN_NYSE)	12.16361	6	0.0584
D(LN_HDB)	24.90958	6	0.0004
D(LN_SIFY)	13.62401	6	0.0341
D(LN_REDFY)	14.38288	6	0.0256
All	116.6586	42	0.0000

D V : D(ln_SIFY)			
Excluded	Chi-sq	Df	Prob.
D(LN_IBN)	13.04419	6	0.0423
D(LN_WIT)	11.08001	6	0.0859
D(LN_RDY)	11.67176	6	0.0697
D(LN_INFY)	6.894852	6	0.3307
D(LN_NYSE)	19.67735	6	0.0032
D(LN_HDB)	5.095233	6	0.5317
D(LN_REDFY)	19.00575	6	0.0042
All	176.0046	42	0.0000

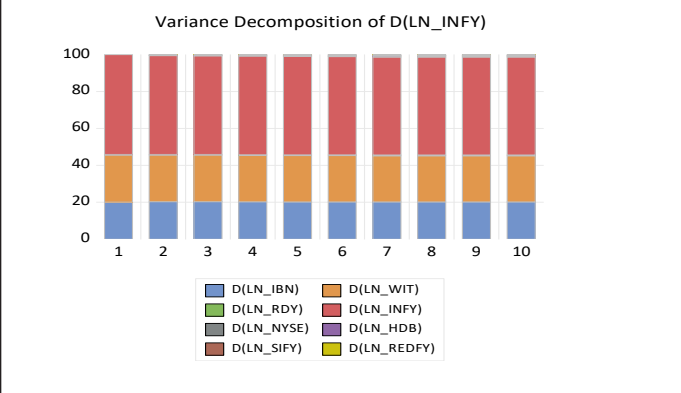
D V : D(ln_NYSE)			
Excluded	Chi-sq	Df	Prob.
D(LN_IBN)	5.653600	6	0.4631
D(LN_WIT)	14.96713	6	0.0205
D(LN_RDY)	3.501464	6	0.7438
D(LN_INFY)	6.205846	6	0.4005
D(LN_HDB)	15.68213	6	0.0156
D(LN_SIFY)	24.69767	6	0.0004
D(LN_REDFY)	12.16771	6	0.0583
All	80.45495	42	0.0003

D V : D(ln_REDFY)			
Excluded	Chi-sq	Df	Prob.
D(LN_IBN)	4.300007	6	0.6361
D(LN_WIT)	3.758762	6	0.7093
D(LN_RDY)	5.453684	6	0.4871
D(LN_INFY)	5.653607	6	0.4631
D(LN_NYSE)	9.423475	6	0.1511
D(LN_HDB)	7.526922	6	0.2748
D(LN_SIFY)	42.45348	6	0.0000
All	129.0244	42	0.0000

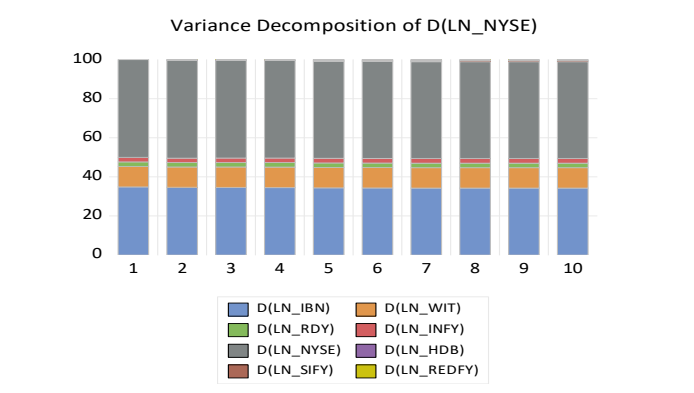
Variance Decomposition using Cholesky (d.f. adjusted) Factors

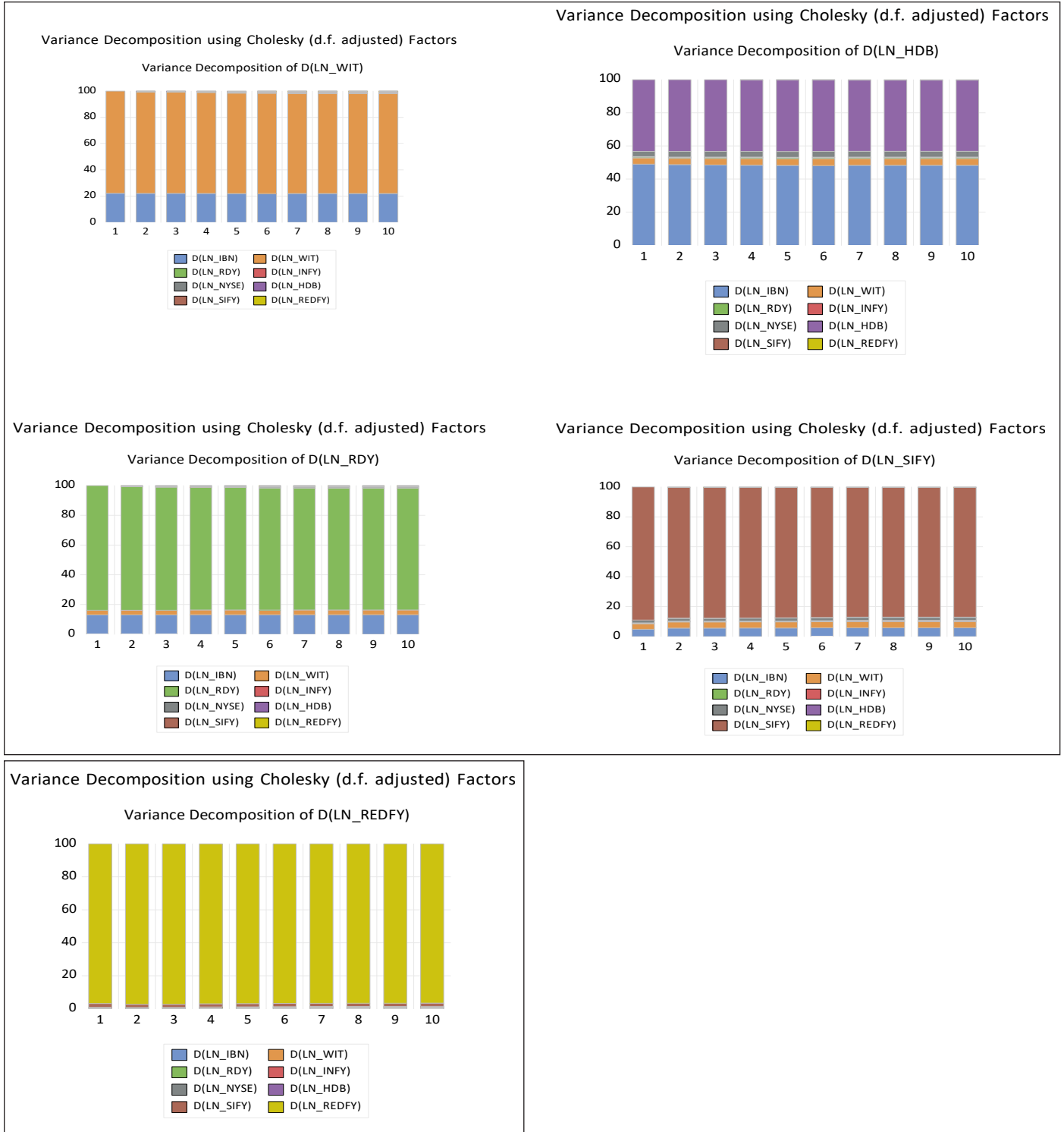


Variance Decomposition using Cholesky (d.f. adjusted) Factors



Variance Decomposition using Cholesky (d.f. adjusted) Factors





Graph 1: Variance Decomposition

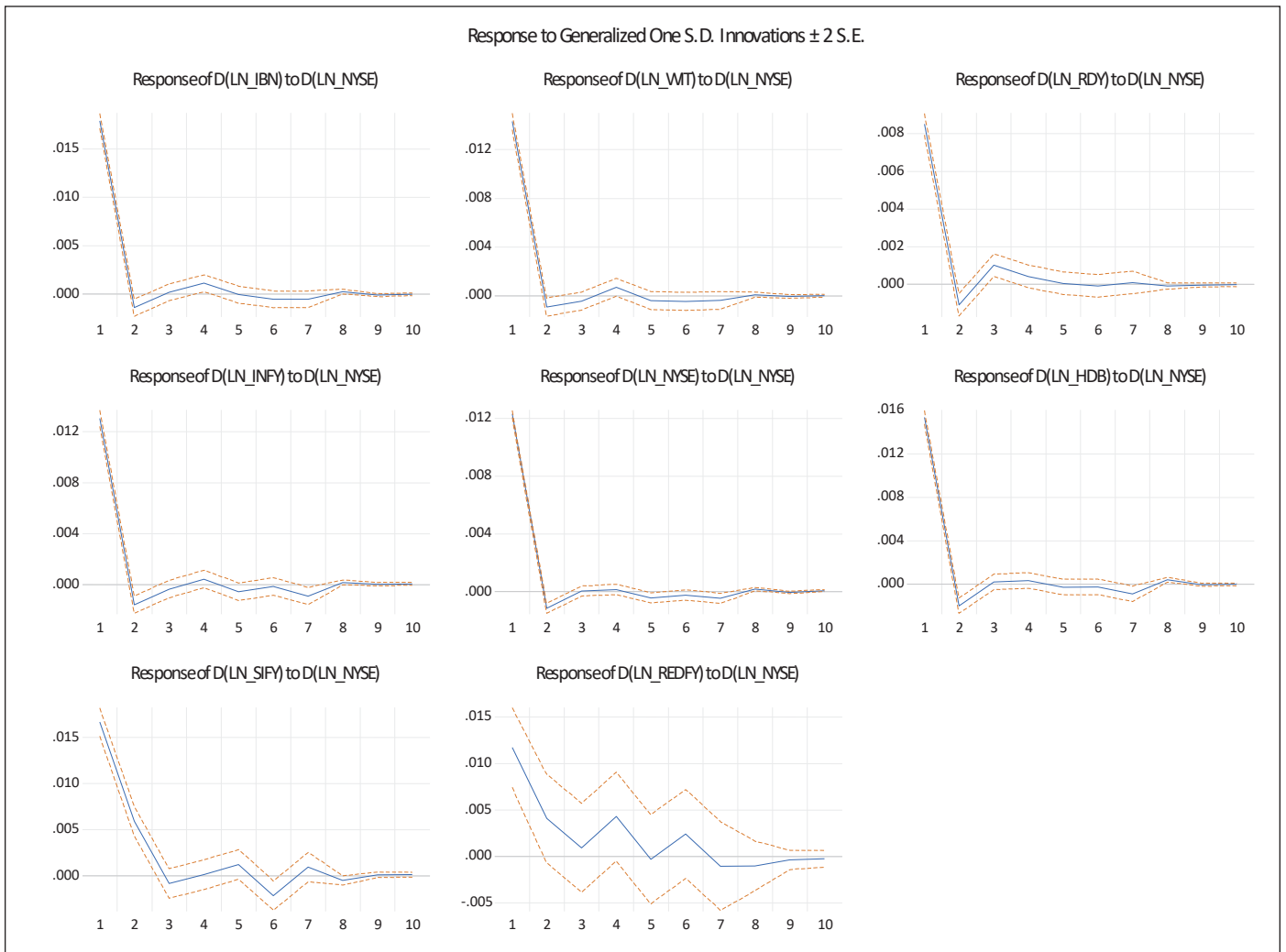
Table 5: Variance Decomposition

	D(LN_IBN)	(LN_WIT)	(LN_RDY)	(LN_INFY)	(LN_NYSE)	(LN_HDB)	(LN_SIFY)	(LN_REDFY)
D(LN_IBN)	98.70913	0.307207	0.110558	0.068528	0.130007	0.265764	0.296326	0.112480
(LN_WIT)	21.97352	76.15468	0.335965	0.614875	0.168876	0.427362	0.227795	0.096925
(LN_RDY)	13.16949	3.173146	81.97488	0.166226	0.579463	0.416421	0.342707	0.177669
(LN_INFY)	20.18888	24.99335	0.429501	53.02811	0.299064	0.494483	0.271479	0.295128
(LN_NYSE)	34.27539	10.42115	2.301283	2.431003	4946713	0.329506	0.507240	0.267295
(LN_HDB)	48.29568	4.106455	0.664514	0.249137	3.501260	42.89087	0.245709	0.046373
(LN_SIFY)	5.917891	4.101555	0.339045	0.529577	1.950515	0.194739	86.61518	0.351496
(LN_REDFY)	0.547152	0.298526	0.091300	0.177845	0.208501	0.159707	1.957182	96.55979

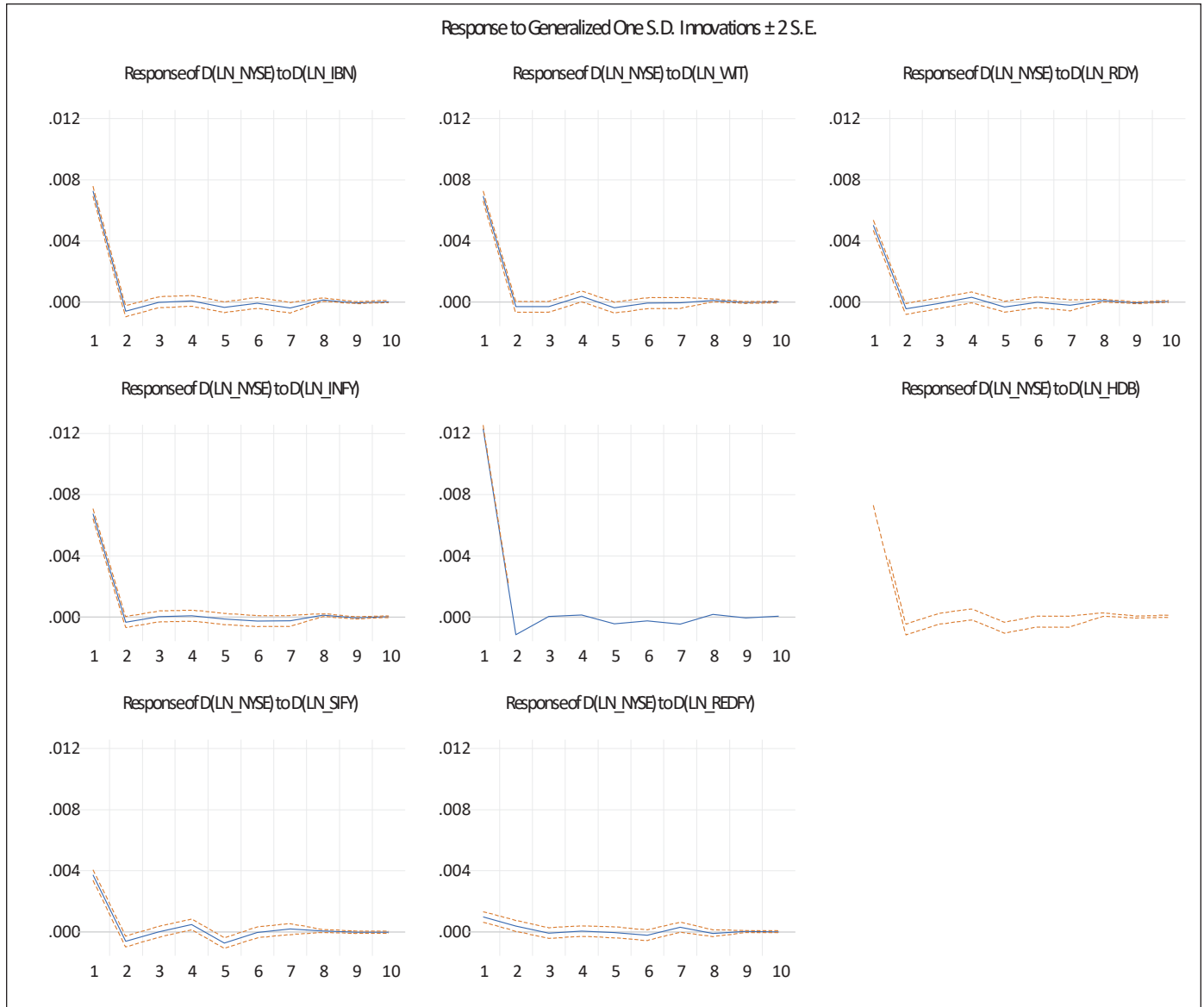
The variance decomposition function provides a slightly different approach to investigating the dynamics of a VAR system. The variance decomposition shows how much of the variation in endogenous variables' movements is due to their own lagged shocks vs. shock from the system's remaining variables' lagged movements.

The result of variance decomposition is presented in the above Graph 1 and Table 5. The graph of variance decomposition of IBN is indicating that it is highly significant with its own contribution. Followed by WIT, where the IBN is contributing 21.97 and the highest variance in the behaviour is explained by its own contribution of 76.15 percent. Next is RDY, the results indicate that 13.16 percent variance in the behaviour of RDY is defined by the daily value of IBN and 81.97 percent variance is explained by its own daily innovation shock. Similarly, in case of INFY, IBN and WIT are contributing 20.18 &

24.99 respectively. Its own daily lag value is significant and representing highest variance in the behaviour is explained by its own contribution of 53.02 percent. In the variance decomposition of NYSE, IBN is contributing 34.37, WIT is contributing 10.42, and the highly significant variation in NYSE is defined by its contribution of 49.46 through its own innovation. The variance decomposition of HDB, it indicates that 48.29 percent of variance in the behaviour of the daily HDB value is defined by the contribution of IBN. The larger contribution by its own shock is defined by the value 42.89. In the variance decomposition of SIFY, NYSE is contributing 1.95 only, and the 86.61 percent variance is defined by its own daily innovation shock. The last variance decomposition of REDFY is contributing 96.55 percent by its own daily innovation shock. The NYSE is only defining 0.20 percent variance in the REDFY, which is very low. The highest variance contribution is caused by the two variables such as IBN and WIT to NYSE.



Graph 2: Impulse Response



Graph 3: Impulse Response

A one standard deviation shock to x generates significant increases (decreases) in y for ‘ m ’ periods (defined by the length of period for which the SE bands are above 0 in the event of an increase or below 0 in the event of a decrease), after which the effect diminishes is the interpretation of impulse response function. The rise peaks in period k . This interpretation aligns well with goals such as “how x affects y ”, when the largest impact is felt, and how the effect lasts. Here a one SD shock of innovation to NYSE initially has declining impact on IBN, WIT, RDY, INFY, HDB, SIFY, and REDFY in periods 2 and 3 and remains in the negative region. From period 2nd the response gradually starts increase and comes into a positive region for IBN, WIT, RDY, and SIFY. Only SIFY responses were negative and

then positive from period 5th to 7th. The shock to NYSE will have asymmetric impacts on the SIFY (Graph 2).

In the graph 3, one SD shock of innovation to SIFY initially has a decline impact on NYSE in the period 2 and then from 2nd period it starts moving to the positive region from period 2nd to 4th period. Again, decline and stayed in the negative region until the shock impact disappears. This represents the asymmetric impacts on the NYSE. Almost similar response recorded in the case of WIT, initially it has declined and stayed in the negative region. After the period, it has moved in the positive region between 3rd to 4th periods. Then again came down to negative territory and stayed there until to the disappearance of shock. The rest of the variable’s response on the one SD shock of innovation to NYSE is initially negative

till to the 2nd period stage and stayed almost between zero to negative till to the disappear of the shock.

CONCLUSION AND IMPLICATION OF THE STUDY

The research examined on the mobility of the US market by using the listed Indian ADR in US stock market and confirmed the nexus between the US market and the Indian ADR. Various tests such as VAR Granger Causality/Block Exogeneity Wald Tests, variance decomposition and impulse response has been incorporated. The proxy variable for US market is NYSE. The result of VAR Granger Causality/Block Exogeneity Wald Test was applied on the time series data (2001-2021), and it explains the bivariate causality between SIFY and NYSE. On the other hand, one-way causality is confirmed where NYSE is caused by WIT and HDB. The two variables IBN and WIT contribution are the highest in the variance of NYSE. One standard shock of innovation to SIFY is representing the asymmetric impacts on the NYSE. This is because of the behaviour of the SIFY, initially it is decline and then came into positive region for a few periods and then again declined to a negative zone. Then one standard innovation shock disappeared. This shows the asymmetric behaviour. Hence, SIFY, WIT and HDB contributing to the mobility of the stock market (NYSE). This can be helpful for the international investor and for the domestic investor (India).

Several research on Depository Receipts have demonstrated their effect on the home country's stock market prices, volatility, and volume. In this study, we examined the dynamic interaction between Indian ADR and the US stock market in this study. Foreign corporations and US investors who invest in ADRs and in the US market. This is where research is crucial and beneficial to both investors. The study also implied the impact of Indian ADR volatility on the US market and to observe the reaction of the US market to changes in Indian ADR pricing. This relation is also beneficial for the Indian Domestic Investors. The study will help the US investor decide their trade volume and strategy in the short run due to the changes in the Indian ADR price.

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META-ANALYSIS OF THE IMPACT OF DEBT UTILISATION ON CORPORATE VALUATION: UNRAVELLING PATTERNS ACROSS INDUSTRIES AND ECONOMIC CONDITIONS

Shweta Goel*

Abstract *Optimum composition of debt and equity is an important factor in assessing the valuation of the company. Companies often faced a problem in choosing the optimum amount of debt in their capital structure. This paper aimed at investigating the relationship between debt and earnings of the company using meta-analysis to ascertain what has been accounted in previous literatures. Using Forest Plot, Confidence Interval: Hypothesis Testing, Test of Heterogeneity and Publication Bias analysis and a sample of published journal articles, it is evident that the Value of business is independent of Debt usage and firms cannot increase the value of its business by increasing the level of Debt. However, an increase in debt-to-equity ratio beyond a certain level will negatively affect their businesses as it increases the level of risk in the business. Therefore, capital structure is not a good fit in explaining changes in the valuation of a company. While capital structure remains an important concern for businesses looking to improve their financial performance, our findings indicate that it may not be the only factor influencing changes in company valuation. In today's changing economic world, educated decision-making and long-term business success require a comprehensive grasp of the intricate interplay between debt, profitability, and risk factors.*

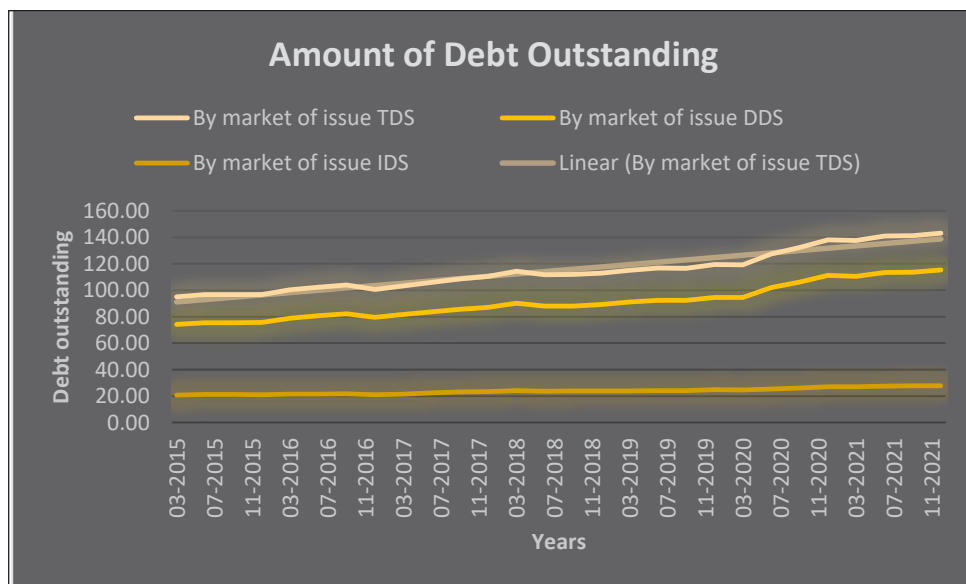
Keywords: *Meta-Analysis, Valuation of Company, Confidence Interval, Heterogeneity*

INTRODUCTION

Every firm needs capital assets to operate its business. To finance capital assets, firms use a combination of debt and equity which represents the capital structure of the company. The importance of capital structure has gained momentum in the last decades. Corporate bond segment act as a stable source of finance when there is volatility in equity, and it also enable companies to customise their assets and liabilities so as to reduce the risk to maturity. Each source of finance has its own implications. A firm with good growth opportunities can raise more capital by issuing debentures while retaining ownership and reduce the overall cost of capital. Debt financing has increased as a proportion to the total world's earnings. There are various factors affecting the performance and valuation of a company. These factors can

be Debt-equity ratio, EPS, bond yield, stock prices, bond rating, etc. On an average, debt issuance by public sector account for two-third of the Indian debt volume. The main factors underlying the growth of debt market is public sector deficit, increasing flow of capital worldwide. Debt securities are generally categorised in terms of the market of issue as international debt securities, domestic debt securities. 'International Debt Securities' (IDS) are issued outside the country in which the borrower resides. They include the instruments traditionally called as Eurobonds and Foreign Bonds except negotiable loans. The IDS statistics are represented by currency, maturity and interest rate, type of the issue, and nationality and residence of the issuer. 'Domestic Debt Securities' (DDS) are issued in the country in which the borrower resides, regardless of the currency in which the security is denominated.

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Sources: IMF; Dealogic; Euroclear; Thomson Reuters; Xtrakter Ltd; national data; BIS debt securities statistics; BIS estimations.

*DDS = domestic debt securities; IDS = international debt securities; TDS = total debt securities.

*Amount calculated in trillions of US Dollars.

*Sample of countries varies across breakdowns shown. For countries that do not report TDS, data are estimated by the BIS as DDS plus IDS. For countries that do not report either TDS or DDS, data are estimated by the BIS as IDS.

Fig. 1

As clearly represented in Fig. 1, IDS increase by nearly 35% from March 2015 to Dec 2021. DDS grow by 55.38% from March 2015 to Dec 2021. TDS accounts for about 51% increase from March 2015 to Dec 2021 which is majorly contributed by increase in DDS.

The valuation of a company is the process of determining the worth of a business. This value is typically based on a variety of factors including revenue, earnings, assets, market conditions, and the overall economic climate. There are several methods used to value a company, including discounted cash flow analysis, comparable company analysis, and discounted earnings analysis. Ultimately, the valuation of a company is an estimation of its future financial performance and potential for growth. This paper is concerned with understanding the impact of the usage of debt on the valuation and earnings of the company by integrating various studies using Meta Analysis tools.

LITERATURE REVIEW

Abhyankar and Dunning (1999) investigated the wealth effects of convertible bond and convertible preference share issues in the UK market. Their empirical analysis provided insights into the impact of these financial instruments on stock prices and demonstrated the relevance of convertible securities in the UK market. Alduais (2020) conducted an empirical study on the earnings-returns association in

China's A-share market. The research provided evidence of the relationship between earnings and stock returns, contributing to the understanding of the market dynamics in China. Collins C. Ngwakwe (2018) analysed the relationship between bond value and share value in the security market. The study shed light on the interplay between bond and share values, offering insights into the valuation dynamics of these securities. Dinh and Pham (2020) examined the effect of capital structure on the financial performance of Vietnamese listing pharmaceutical enterprises. The study explored the relationship between capital structure and financial performance, providing valuable insights for the pharmaceutical industry in Vietnam.

Enow (2022) conducted a meta-analysis to investigate the effect of capital structure on profitability. By synthesising previous research findings, the study provided a comprehensive understanding of the relationship between capital structure decisions and firm profitability. Feihle and Lawrenz (2017) studied the issuance of German SME bonds and its impact on operating performance. Their research highlighted the implications of SME bond issuance on the operational performance of German companies, providing valuable insights for the SME financing landscape. Gill (2011) examined the effects of capital structure on profitability in the United States. The study contributed to the understanding of the relationship between capital structure decisions and firm profitability, offering insights

for financial decision-making. Hong (2016) investigated the effect of debt choice on firm value. The research focused on the impact of debt financing decisions on firm value, providing valuable insights into the determinants of firm value and the implications of debt choice.

Lestari (2021) conducted an empirical study on the relationship between debt securities issuance and operational performance of banks in Indonesia. The research examined the impact of debt securities on the operational performance of banks, offering insights into the Indonesian banking sector. Nzau, Kung'u, and Onyuma (2019) explored the effect of bond issuance on the financial performance of firms listed on the Nairobi Securities Exchange. The study provided insights into the relationship between bond issuance and financial performance in the Kenyan market. Moghadas, Pouraghajan, and Bazugir (2013) investigated the impact of capital structure on firm value in the Tehran Stock Exchange. The study contributed to the understanding of the relationship between capital structure decisions and firm value, focussing on the unique context of the Iranian stock market. Oh and Kim (2016) examined the effect of ownership change and growth on firm value at the issuance of bonds with detachable warrants. Their research shed light on the implications of ownership change and growth for firm value, providing insights into the impact of these factors on the issuance of bonds. Rjoub, Civcir and Resatoglu (2017) explored the micro and macroeconomic determinants of stock prices in the Turkish banking sector. Their research provided insights into the factors influencing stock prices in

the Turkish banking sector, contributing to the understanding of the dynamics of the sector.

Sakr and Bedeir (2019) investigated the impact of capital structure on the performance of non-financial listed Egyptian firms. The study examined the relationship between capital structure decisions and firm performance in the Egyptian context, offering valuable insights for non-financial companies in Egypt. Salim and Yadav (2012) examined the relationship between capital structure and firm performance in Malaysian listed companies. Their research contributed to the understanding of the relationship between capital structure decisions and firm performance in the Malaysian context. Wang and Wang (2022) explored the relationship between ESG (Environmental, Social, and Governance) performance and green bond issuance. The study provided insights into the impact of ESG performance on the issuance of green bonds, contributing to the understanding of sustainable financing practices.

As already mentioned, several factors affect a company's value, and it is recognised that the capital structure is one of the factors that has a significant impact. Optimal capital mix minimises weighted average cost of capital. This will increase the market value per share. Capital composition usually consists of debt and equity and changes in debt or equity levels also change the value of a company. Different empirical studies were conducted to investigate the relationship between the issuance of debt and earnings of the company. They produce conflicting results. Table 1 presents the findings.

Table 1

Study (Author and Year of Study)	Country	Period	Dependent Variables Used for Earnings and Valuation	Independent Variables Used for Debt	Summary of Findings
Samuel Tabot Enow (2022)	South Africa	2005-2021	Profitability	Capital Structure	Increasing the debt-to-equity ratio above a certain level will negatively impact their business by increasing the level of risk in the business.
Shanshan Wang (2022)	China	2016-2020	Green bond Issuance	ESG rating scores	The study identified the negative effect of firm's financial performance in green bonds issuance by incorporating the effect of ESG performance. It also reveals that companies do not prioritize ESG practices in their business strategy in short run.
Rohmini Indah LESTARI (2021)	Indonesia		ROA	BLTD, NIM	More debt issuance harm company performance
Fahd Alduais (2020)	China	2007-2016	Stock return	EPS, Market Price	Earnings are positively correlated with the return of the previous period.

Study (Author and Year of Study)	Country	Period	Dependent Variables Used for Earnings and Valuation	Independent Variables Used for Debt	Summary of Findings
Hung The DINH (2020)	Vietnam	2015-19	ROE	LEV, Debt-Asset ratio	There is a link between the capital structure and the financial performance of publicly traded pharmaceutical companies in Vietnam.
Mary M. Nzau (2020)	Kenya	2008-17	ROE	Bond price, Coupon rate	The financial performance of the companies surveyed was impacted by the behavior of the components of bond issue.
Ahmed Sakr (2019)	Egypt	2003-2016	ROA	TD	Total debt has a negative impact on the firm performance measured by ROA
Collins C Ngwakwe (2018)	South Africa	2016-2017	Bond Value	Share value	The results revealed a significant but negative relationship between the value of stocks and the value of bonds, indicating that the increase in value of the stock results in a likely decrease in bond value.
Soonwook Hong (2017)	South Korea		Market value of equity	ROA, LEV	The type of debt selected is among the various factors that influence firm value.
Patrick Christian Feihle (2017)	Germany	2009-19	NI	SIZ, LEV	Issuers actually display lower post-issuance operating performance which amplifies their financial fragility
Husam RJOUB (2017)	Turkey	1995-2015	Stock prices	CAR, AQ, MQ, EAR, LIQ	Asset quality, management quality, profits are statistically significant in explaining share prices.
Sekyung Oh (2016)	Korea		Value of firm	Leverage	Detachable Bond warrants issuance has a positive effect on firm value when it is issued in the form of a public offering. The findings suggest that the ownership structure, cash flow position, and kind of issuance of the issuing firm play significant roles in determining the association between the issuance of detachable BWs and firm value.
Atena Moghadas (2013)	Iran	2006-2010	MV	REV Gw, AST Gw	There is a significant relationship between asset growth and increase on firm value.
Mahfuzah Salim (2012)	Malaysia	1995-2011	ROE, ROA, Tobin'sQ, EPS	LTD, STD, Growth	Tobin's Q (company return) is positively related to the capital structure.
Abhay Abhyankar (1999)	UK	1986-1996	Wealth	CB, CPfS	Negative wealth impacts for companies that issue convertible securities to refinance past debt or fund specific acquisitions.

EPS= Earnings per share

LEV= Leverage

TD= Total Debt

SIZ= Size

AQ= Asset Quality

LIQ= Liquidity

EAR= Earnings

ROA= Return on assets

BLTD= Bonds to Long term debt

NIM= Net Interest Margin

ROE= Return on equity

NI= Net Income

CAR= Capital Adequacy Ratio

MQ= Management Quality

MV= Market value

REV Gw = Revenue growth

AST Gw= Asset Growth

LTD= Long term debt

STD= Short term debt

CB= Convertible Bonds

CPfS= Convertible Preference shares

RESEARCH METHODOLOGY

A meta-analysis is a statistical method for combining the results of multiple studies to provide a more robust and accurate estimate of the effect size of a particular intervention or treatment. The aim of a meta-analysis is to reduce the random error associated with individual studies and to increase the precision and validity of the results. The results of the meta-analysis are often reported as an overall effect size, with a corresponding measure of statistical significance, as well as a measure of the heterogeneity of the results across the individual studies. This tool was initially developed in pharmaceutical and psychological research for testing the outcomes of a treatment. However, meta-analysis is now more frequently utilised in the field of social sciences as a way to test hypotheses. However, one has to carefully look at the assumptions of meta-analytic hypothesis testing in the social sciences to determine whether they will be met under real-life conditions or not.

Assumptions

While using the meta-analysis tool, researchers should verify that the following assumptions are true:

Independence: The studies being analysed should be independent of each other and not influenced by the same underlying factors.

Homogeneity: The studies being analysed should have similar research designs, populations, and outcomes.

Normal Distribution: The effect sizes in the studies being analysed should be approximately normally distributed.

Correctly Calculated Effect Sizes: The effect sizes should be accurately calculated and reported in the studies.

No Publication Bias: The studies included in the meta-

Forest Plot

analysis should not be systematically biased towards positive results.

It's important to note that these assumptions are not always met in practice and can impact the validity of the meta-analysis results.

This study made use of a software known as Meta Essentials, which divides the analysis into various segments namely Forest Plot, Subgroup analysis, Moderator Analysis, Publication Analysis and Calculations. More specifically, the Forest Plot is used for a graphical display and shows the confidence interval. It also shows the extent of Heterogeneity. ‘A small effect size means that measures of capital structure can adequately account for profitability’. Also, the Chi square test is relevant in assessing the dependence of profitability on capital structure.

Using the data values from a sample of 17 published articles the following hypothesis were examined.

H0: The level of significance is more than 0.05; therefore, value of firm is related and dependent of debt usage in capital structure.

H1: The level of significance is less than 0.05; therefore, the value of the firm is not related and independent of debt usage in capital structure.

H2: There is some biasness in the selection of research studies that are showing statistically significant results rather than statistically non-significant results.

H3: There is no biasness in the selection of research studies that are showing statistically significant results rather than statistically non-significant results.

DATA RESULTS

The following results were obtained from the software used “Meta Essentials”.

Table 2: Results of Forest Plot

Study Name	Cohen's d	CI Lower Limit	CI Upper Limit	Weight
Effect of ownership change and growth on firm value at the issuance of bonds with detachable warrants	0.09	0.03	0.15	6.10%
Wealth effects of convertible bond and convertible preference share issues: An empirical analysis of the UK market	0.02	-0.11	0.14	6.05%
An empirical study of the earnings–returns association: evidence from China's A-share market	0.08	0.06	0.09	6.11%
The Effect of Capital Structure on Financial Performance of Vietnamese Listing Pharmaceutical Enterprises	-1.14	-1.32	-0.96	5.99%
Effect of Bond Issuance on Financial Performance of Firms Listed on Nairobi Securities Exchange	0.55	-0.04	1.15	5.37%

Study Name	Cohen's d	CI Lower Limit	CI Upper Limit	Weight
Investment and the Cost of Capital: New Evidence from the Corporate Bond Market	-1.38	-1.41	-1.34	6.11%
Stock Market Reaction to Green Bond Announcements.	-0.50	-0.71	-0.29	5.94%
The Relationship Between Debt Securities Issuance and Operational Performance: An Empirical Study of Banks in Indonesia.	-1.69	-1.87	-1.51	5.98%
The Effect of Debt Choice On Firm Value.	0.12	0.09	0.16	6.11%
A Study on Foreign Currency Convertible Bonds FCCBs Theory and Evidence from Corporate Bond Market of India.	-0.19	-0.38	-0.01	5.98%
Effects of Debt on Value of a Firm.	-0.02	-0.30	0.26	5.81%
Announcements Effect of Corporate Bond Issuance and Its Determinants.	-0.12	-0.41	0.17	5.80%
The effect of capital structure on profitability: Evidence from the United States.	0.11	0.00	0.23	6.06%
Impact of capital structure on firm value: Evidence from Tehran Stock Exchange.	0.16	0.06	0.27	6.07%
Micro and Macroeconomic determinants of stock prices: the case of Turkish banking sector.	0.08	0.00	0.15	6.09%
Impact of Capital Structure on Firm's Performance: Focusing on Non-financial Listed Egyptian Firms.	-2.18	-2.94	-1.42	4.45%
Capital Structure and Firm Performance: Evidence from Malaysian Listed Companies.	-0.35	-0.54	-0.17	5.98%

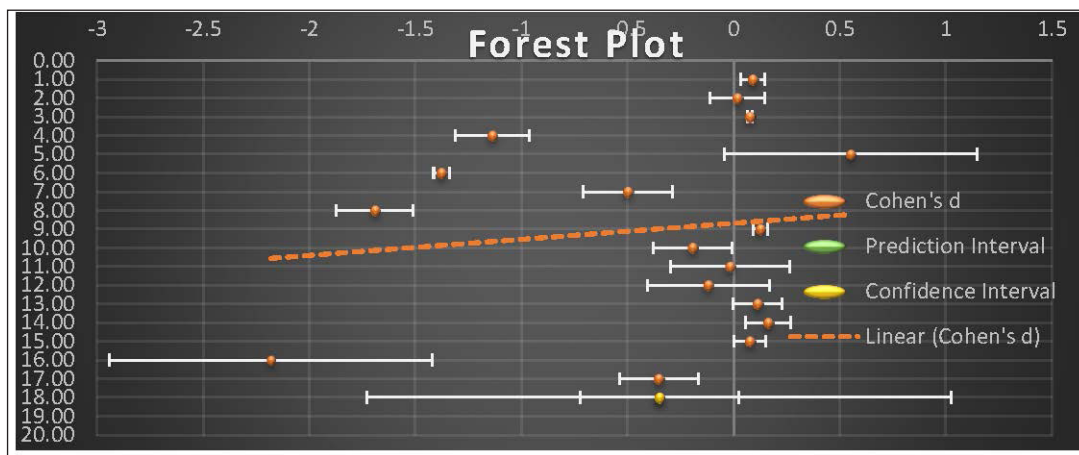


Fig. 2: Forest Plot in Meta Essentials

Interpretation

Fig. 2 represents the meta-analysis of a forest plot. The x-axis represents the scale of effect size, plotted on the top of the plot. Each line represents the estimate of the size of the effect of a study in the form of a point using the 95% confidence interval. It is a good way to represent the results of a single study, such as an estimate of an interval in which the “true” effect is very likely. In this study also, it is our assumption, as mentioned before that every study in the meta-analysis is taking the probability sample of a specified population. Without fulfilling this assumption, no result can be made from the “sample” to a population and comparing the observed effect size with observations in the studies is not

reliable. In the above figure, some effect sizes are positive, and some are negative. These studies show that majority of the studies are statistically significant. Some of them have statistically negative and statistically positive effects. In the above forest plot, Cohen's d is -0.35 which signifies medium effect size and negative correlation between two variables. Therefore, the value of a firm is not related to and independent of debt usage in its capital structure.

Confidence Interval: Hypothesis Testing

The combined effect size in the above forest plot includes zero. At a confidence level of 95% its p-value is smaller than .05. and it shows that it has a significant effect. The aim in

this study of meta-analysis is hypothesis testing. *p*-values (one-tailed and two-tailed) are found and shown in the data mentioned below (measured in *Meta-Essentials*). Both the *p* values are less than .05.

Z-value	-1.99
One-tailed <i>p</i> -value	0.023
Two-tailed <i>p</i> -value	0.047

In this table, I^2 is large, i.e., 99.75%, then such an analysis is likely to be worthwhile. This is because of the very high proportion showing that the studies in this meta-analysis cannot be considered to be studies of the same population. The effect size variance is shown by T^2 . The *t* statistic estimates the standard deviation of the distribution of effect sizes with the assumption that the effect sizes are normally distributed.

Estimating the Extent of Heterogeneity

The plot in Fig. 1 itself suggests that there are different effect sizes in different types of populations. In other words, the domain that is analysed in this meta-analysis must be seen as “heterogeneous”.

Heterogeneity

Q	6394.10
P_Q	0.000
I^2	99.75%
T^2	0.39
T	0.62

Publication Bias Analysis

The research studies taken in a field of study can be biased in many ways. Publication bias analysis is concerned with selection bias that might occur due to the selection of studies, especially when some studies are published, and others are not published. There might be chances that majorly those studies have been selected which have a statistically significant result rather than a statistically non-significant result or vice-versa. As a result, the study’s estimated cumulative effect size may be higher than it actually is. This potential publishing bias is intended to be signalled by the publication bias analysis.

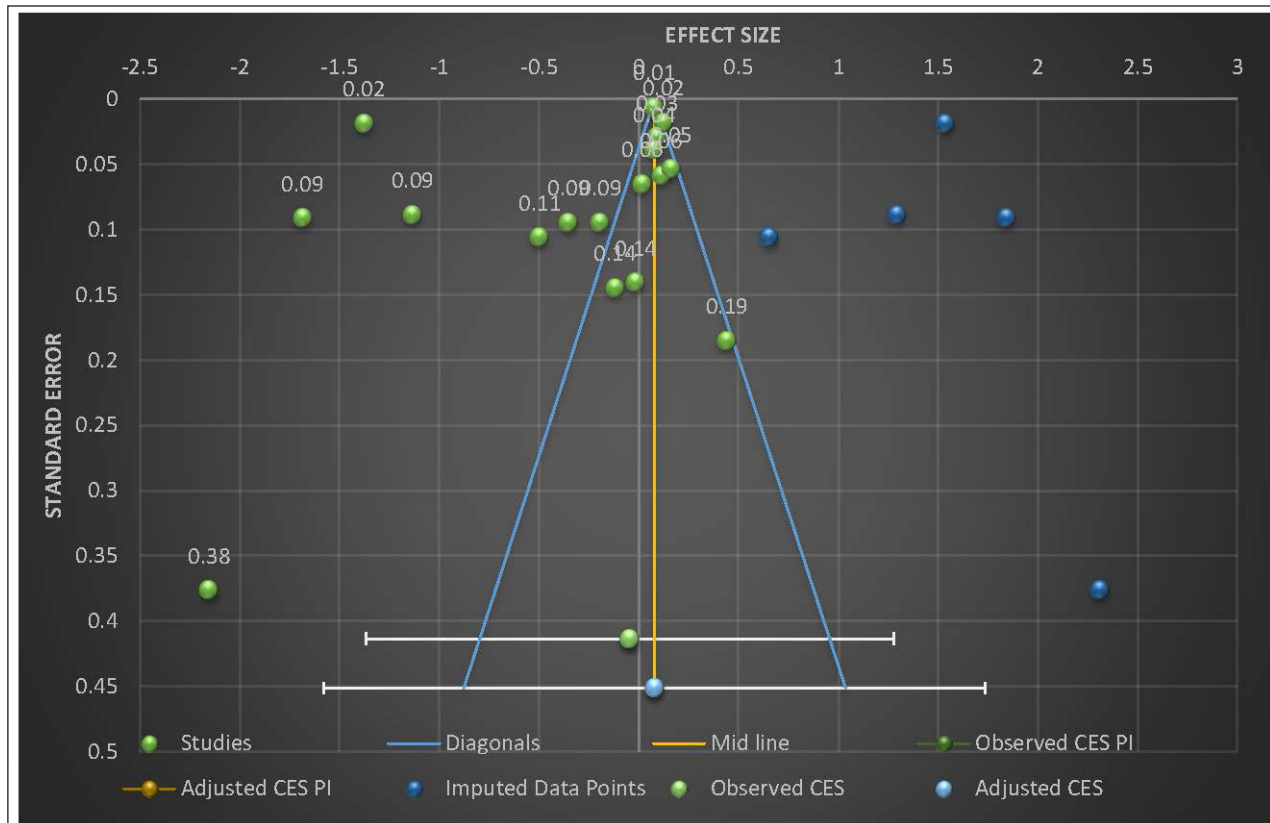


Fig. 3: Funnel Plot Showing Standard Error of Different Studies

Meta-Essentials includes various analysis which indicate publication bias. One analysis is a funnel plot. We made the assumption in our meta-analysis study that observed effect sizes with comparable standard errors should be more or less symmetrically distributed around the total effect size. In our study, almost all the standard errors are closer to .05 and there are some imputed data points (based on the Trim-and-Fill method), the funnel plot indicates there is some asymmetry in the distribution of effect sizes (Fig. 3). The Trim-and-Fill method would then impute one or more studies in this situation, adjusting the overall effect size to account for the potential absence of the missing studies. Therefore, H_0 and H_3 are rejected while H_1 and H_2 are accepted.

CONCLUSION

The purpose of this study was to investigate the effect of debt usage on the value of firm using a meta-analysis. This study used a sample of 17 published articles across different journals to investigate this relationship with a Forest Plot, Confidence Interval: Hypothesis Testing, Test of Heterogeneity and Publication Bias analysis. From the analysis, it is evident that the value of business is independent of debt usage and firms cannot increase the value of its business by increasing the level of debt. However, increasing the debt-to-equity ratio beyond a specific level will negatively affect their businesses because it increases the extent of risk in the business. Although a growing business will generally have an aggressive strategy in financing its growth with debt, this should not be analysed in line with the valuation of business.

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LIST OF ABBREVIATION

CR= Coupon Rate

ROA= Return on assets

MV= Market value

INF= Inflation

BLTD= Bonds to Long term debt

REV Gw = Revenue growth

EPS= Earnings per share

NIM= Net Interest Margin

AST Gw= Asset Growth

LEV= Leverage

ROE= Return on equity

LTD= Long term debt

TD= Total Debt

NI= Net Income

STD= Short term debt

SIZ= Size

CAR= Capital Adequacy Ratio

CB= Convertible Bonds

AQ= Asset Quality

MQ= Management Quality

CPfS= Convertible Preference shares

LIQ= Liquidity

EAR= Earnings

DDS = domestic debt securities;

IDS = international debt securities;

TDS = total debt securities

EPS= Earning per share

EVALUATING SMES EXCHANGE AS AN EMERGING PLATFORM IN INDIA

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Abstract *Stock exchanges are the cornerstones of every nation's growth, and capital markets are the nation's foundation too. Hence, the growth of the Stock Markets of the world is directly related to the production of the economy of every country. It can be noted from the last few years that the stock markets have expanded to suit the unmet needs. Stock market improvement has been created, and different products have been produced to meet the requirements. Commodities and the financial markets are the correct examples. The goal of this paper is to assess that the SME exchange provides companies with a new forum from which they can transfer to the exchange's main board. Till 2022, 107 companies have been transferred from NSE Emerge to the NSE mainboard market. The research hypothesis of the paper is to measure the performance of the companies that migrated from the SME's exchange to the main board of the NSE market. Using the independent sample t check with SPSS tools, we took a survey of 107 companies from the NSE Emerge that is being evaluated for their success before and after migration. This study's added value is to measure that whether the migration is a mean of increasing the profitability of the migrated company or not. We used the statistical tool independent sample t test on pre- and post-migration return differences. Our analysis reveals that when a corporation opts for a main board (NSE) listing, its shares often generate a favourable anomalous return although it was not found significant for post-migration return capabilities.*

Keywords: Stock Market, SME Exchange, Economy, Financial Market, NSE

J E L Classification: G120, G140, G170

INTRODUCTION

SME stands for Small, Micro & Medium Enterprise. It is governed by the Micro Small and Medium Enterprise (MSME) Act, 2006. As per this act, SME is defined as companies that spend more on their plants and do not cross Rs 10 crore. SMEs are subdivisions of small enterprises, which are the guiding force behind economic development in India. Compared to other major economies, India also has a decent share of small and medium-sized companies, which forms a significant part of the economic base and contributes particularly to the country's exports and GDP. Indian SMEs today manage different industries, varying from conventional to contemporary, vying consistently with the strongest (Joshi & Mehta, 2023).

An SME Exchange is a trading platform for a registered stock exchange, with national trading terminals approved by SEBI to list MSME corporate securities (shares). The structure for SME platforms on stock exchanges to serve SMEs was developed by SEBI vide its 18-May-2010 circular. In 2011,

BSE and NSE were authorised for the development of their respective SME sites, and subsequently the launch of BSE SME and NSE Arise. A total of 307 firms listed on the BSE SME platform as of today, and 69 of those have already moved to the mainboard market. Similarly, 202 companies are trading on NSE Emerge and out of which 107 were take-over / migrated to the NSE exchange mainboard (till 2022).

A private entity, patented corporation, or joint business will first be turned into a public limited organisation to record the existence of the NSE. Both websites, aside from the provision of compulsory stock dematerialisation and 100 percent underwriting, have their own certification requirements for SME listings. Parameters for listing on NSE's SME platform, namely emerge requires post-issue paid-up capital not to surpass Rs 25 crore, the organisation should be operating for at least three years, the organisation should have positive cash accumulation (EBDT) from transactions for at least two fiscal years, with a healthy net worth and no postulation should be made against the applicant entity. Although the key advantage of being enrolled in the SME

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exchange for businesses is the ease of using funds to grow their sector, several other fascinating reasons have driven the number of enumerations on both SME platforms in India. Leading advantages provide Convenience to access funding and borrowing possibilities: SMEs were unwilling to reach investors to raise equity and loans to fund their initiatives because of the efficiency and operating frameworks of their sector (Nanda et al., 2023). None of these potential Greenfield projects are incapable of being adopted or conducted because of insufficient financial flexibility. They find a solution for the financing-raising problem, with the relief of IPO requirements for SMEs. Listing of SMEs offers an avenue to boost financing for growth-oriented SMEs through equity extraction. It, therefore, is quick to start sourcing the financial obligation: Listing offers borrowers recognition and a sense of stability attributable to the needs of firm governance.

This lets identified small and medium-sized businesses collect debt with ease. In addition, listed companies can be collateralised by the promoter to secure loans which can then be merged into the business, with few regulatory standards; as opposed to an IPO on the mainboard platforms, the SME IPO has many relaxations in terms of regulatory oversight and standards, both at the time of the launch of the IPO and on routine agreements under the listing standards and regulations (BR & Desai, 2024). The listing also offers SMEs a stronger reputation and financial standing, contributing to higher company value on the one hand, and increased customer-customer trust on the other. In addition, banks and financial institutions tend to finance a listed SME as opposed to an unlisted entity. Alternatives for inorganic growth open up; equity investment offers incentives for creation such as extension, mergers, and acquisitions, becoming cost-effective and tax-efficient, and going to the mainboard helps the SME get rid of the SME name.

REVIEWS OF LITERATURE

Many studies were conducted on measuring the role of SME exchanges on the development of the anise and nations. It is well-founded that entrepreneurship is key to economic development and hence a thriving SME market (Baloyi & Khanyile, 2022; Onyedikachi et al., 2022). Finance availability by financial intermediaries is a required contribution to the process (Grassi et al., 2022). Xu (2022) and King et al. (1993) state that “the scale of the structured financial intermediary market about GDP and the proportion of credit available to private companies are clearly and robustly associated with economic growth.” Graff (2001) reveals that it is well-founded that entrepreneurship is key to economic development and hence a thriving SME market (Lateef & Keikhosrokiani, 2022). Finance availability by

financial intermediaries is a required contribution to the process. Jansen et al. (2022) state that SMEs prefer internal equity to leverage and leverage to external equity according to the pecking order principle, although they only use external equity (Venâncio & Jorge, 2022).

The pecking order is affected by considerations such as the ability of owners to retain leverage (Berggren et al., 2000); their risk avoidance (Bolton & Freixas, 2000); and their awareness of trade, competitiveness, and investment prospects (Bulan & Yan, 2010). Information gaps in funding opportunities for SMEs can represent gaps in skills and expertise.

Further, the impacts of SME exchanges on SMEs are measured by other researchers, and their work is highlighted as under: Kyophilavong et al. (2007) performed a study on SMEs using over 16,000 samples in Laos. The study sought to classify factors that would decide the accomplishment of SMEs in Vientiane and other provinces. The key approaches used in their study were the Logit model and multiple regressions. The study showed that unpredictable exchange rates and domestic ownership have negative effects on the output SME’s, whereas those of money, labour, state-owned enterprises, and private enterprises have the opposite effect (Kyophilavong et al., 2007). However, the report was unable to demonstrate subsector success such as handicrafts, wood processing, and the like. The Minister of Manufacturing and Handicraft and the United Nations Organisation for Development (UNIDO 2001) Conducted surveys of small and medium-scale businesses in Vientiane and other 200 sample-based provinces. They showed that SMEs continue to face many constraints, such as lack of access to finance and inefficiency in production. They also suggested that SMEs develop management expertise and technical capabilities to become more successful (Chattha, 2019). Joint research of ADB and the World Bank (2007) looked into the investment climate. It was based on a 2005 Investment Climate Survey (ICS). Even, there has been no research in Laos on SMEs’ innovativeness, business growth, networking, and competition. That’s the gap they are going to fill.

Sharma et al. (2018) examined that SMEs are drivers of development for every nation in the world. According to the World Bank, structured SMEs in emerging economies have generated 45 percent of total jobs and around 33 percent of national income (GDP). Primarily in Asia and Sub-Saharan Africa, it is projected that over the next 15 years, ~600 million workers would be required to employ the rising population worldwide. SMEs have the largest number of workers. Therefore, many small and medium-sized businesses fail and stagnate because they have little access to financing which is a main restriction to SME development.

Raj (2018) revealed that the SME industry accounts for 8% of the country's GDP, 45% of manufacturing output, and 40% of exports. There is much more to the regional spread of this field. SMEs are also essential for sustainable development goals, i.e., success of equity and inclusion. SME industry contribution to the country's GDP is 8 percent, 45 percent of manufacturing production, and 40 percent of exports (Ruzmatovich & Safaraliyevich, 2023). The labour-to-capital ratio is far higher than the major businesses only because the SMEs offer job prospects across 26 million enterprises to around 60 million people (Christoffersen et al., 2023). Also, the SMEs' regional orientation is perfect. Thus, it can be inferred that SMEs will achieve the national targets of balanced development for success in terms of equality and equity.

Tripathi et al. (2017) examined the production of IPOs released and listed on the websites of BSE SME and NSE emerge. He found that the platform is gaining traction over time, the number of companies listed on these platforms is that day by day, and the average issue size of the individual IPO is about 8 crores, which is amazing. It also shows that an average of 10.60% of SME IPOs are underpriced. The outcome is compatible with the original under-pricing phenomenon and is widely acknowledged (Strommer et al., 2023). It can be observed that according to ANOVA, the gap is not statistically important as per the result and that there is a diminishing tendency in the magnitude of the under-pricing for the given period. Two variables appear to move in conjunction which was illustrated by the correlation analysis, and thus a substantial association between subscription rate and under-pricing was established. The research has consequences for taxpayers, small companies, investment banks, and regulatory bodies (Lakshmanasamy, 2022).

Nguyen, Chaiechi, Eagle, and Low (2019) examine the changing productivity and mutual impact of thin exchange, systemic breaks, and growth on dual long memory in the Hong Kong, Singapore, Thailand, and Malaysian Small and Medium Business capital markets. The state-space models Garch-M, etc. are accepted. Findings indicated the economies of Hong Kong and Singapore show future productivity characteristics, indicating the success of many structural reforms. The three aforementioned variables combined have decreased impacts on long-memory predictions' severity and/or statistical importance. The markets in Thailand and Malaysia express power stability in uncertainty, suggesting a strong risk management buffer for the portfolio.

Handley, Wright, and Evans (2018) Develop guidelines for streamlined decision-making practical Australian SME's Financial Reporting. It is the nation that has historically permitted certain organisations to use a broad variety of reporting requirements. A sample survey of non-government

NNGOs examines stakeholder claims for and against small and medium-sized businesses that have a smaller amount of detailed reporting and classifies the line items that could be more helpful to users when making decisions.

Guo et al. (2017) Recognition of opportunities is crucial for SMEs, but SMEs face difficulties in identifying recognised opportunities. Dwyer and Kotey (2015) revealed that a considerable proportion of SMEs require outside finance. Using the grounded theory technique, interviews with six owners and 13 accounting and legal consultants reveal an inherent lack of knowledge about initial public offerings (IPOs) and the National Stock Exchange of Australia (NSX) among SME owners and their attorneys. According to the report, NSX's poor success is attributable to a lack of exposure, limited listings, a lack of subscribers, thin trading, lengthy processes, and a lousy location. The NSX is trapped in a vicious cycle of negative results that threatens its viability. It cannot generate enough listings to provide the income required for a profitable service. Increased exposure of small company advisers to the IPO process could boost demand for public stock via the NSX.

Asadi et al. (2023) explored the impacts of central firm information force and vulnerability on hierarchical trust and the resulting execution of SMEs. Ojha et al. (2023) uncovered that the information force of the central firm will have a positive relationship while vulnerability will have a negative relationship between authoritative trust in a trade relationship with a positive connection among trust and SME execution in 565 German SMEs.

RESEARCH METHODOLOGY

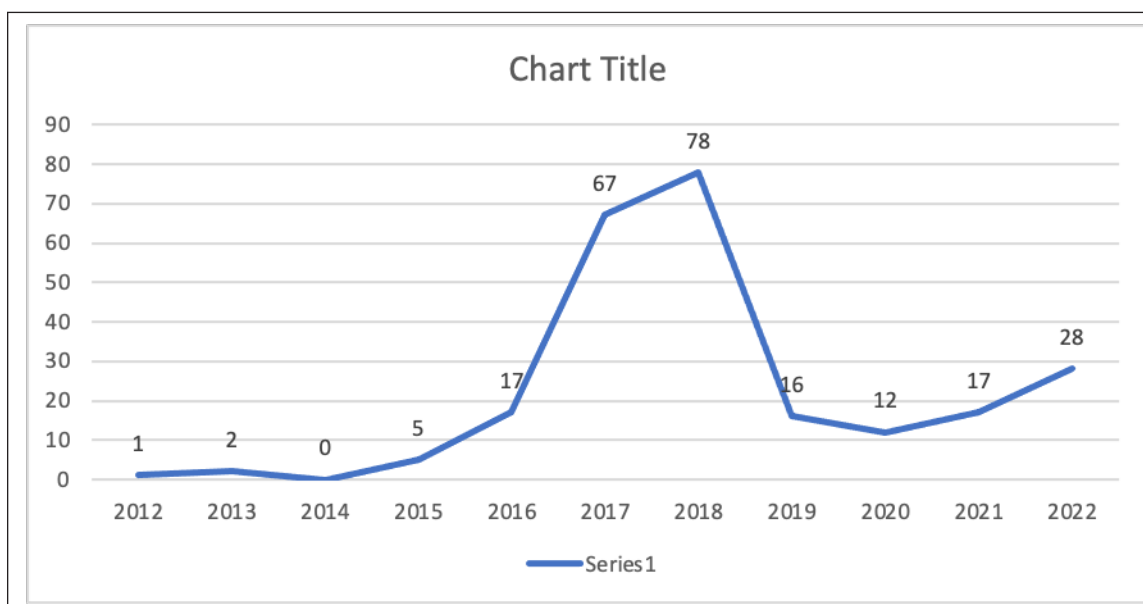
The population of the present study consists of all listed companies in NSE that emerged and moved from the SME platform to the main board of the NSE EMERGE Platform. In total, 107 companies during the period of the study are thus included in the study.

To achieve the purpose of this analysis and to perform the investigation, data were collected from secondary sources through the NES Emerge platforms, with the selected companies' annual reports. The present study covers seven years from January 2012 to December 2022 to examine the issues related to growth; return, IPO performance, and performance of 107 migrated companies still working on the reported date in the mainboard of the NSE platform. In the current study, 107 out of 122 companies were selected using random sampling from the numerous industries identified under NES Emerge platforms. To carry out this research work, an independent sample t-test is used with the SPSS software to measure their performances before and after migration.

The Outcome of the Research Process and Conclusions

A leading quality of SME IPOs remains the condition of movement to the mainboard platform. After crossing the edge of Rs.10 crore money, any company listed at the NSE will be able to move to the mainboard and, after passing the

Rs. 25 crore edge, will have to switch compulsorily to the mainboard. However, these companies need to be listed in the SME markets for a period of two years before they can switch to the mainboard. There were 243 companies listed in NSE Emerge, 107 of which migrated to the mainboard during the time of analysis (till 2022). Fig. 1 represents the year wise-number of new companies listed for their IPO in the NSE Emerge platform as under:



Source: Own study.

Graph 1: No. of Companies Listed on NSE Emerge

The graph reveals that the companies listed on the NSE Emerge platform are until 2022 but only nine new companies appeared on the site in the last year of 2019.

Of the 122 companies that moved to the main board, 107 companies were chosen for the current study as seen in Table 1.

Table 1: Concept of Migration from SME Exchange to Mainboard Exchange

Name of the Scrip	Migration Date	Return Post Migration (in %)	Total Return (in %)
Sarveshwar Foods Limited	08-Dec-22	0	0.73
Osia Hyper Retail Limited	01-Dec-22	0.45	4.65
AAA Technologies Limited	28-Nov-22	10.25	21.46
Vinny Overseas Limited	28-Nov-22	8	19.98
B&B Triplewall Containers Limited	23-Nov-22	0.56	-0.3
Hindprakash Industries Limited	07-Nov-22	8.67	8.91
Ace Integrated Solutions Limited	04-Nov-22	2.5	-4.14
Bohra Industries Limited	27-Oct-22	12.5	6.36
Narmada Agrobases Limited	27-Oct-22	0	-14.59
DC Infotech and Communication Limited	19-Oct-22	24.88	14.42
SecUR Credentials Limited	17-Oct-22	5	-4.08
Ksolves India Limited	23-Sep-22	6.6	5.93
Kshitij Polyline Limited	27-Jul-22	-4.8	-1.33

Name of the Scrip	Migration Date	Return Post Migration (in %)	Total Return (in %)
We Win Limited	15-Jun-22	2.29	4.6
Silver Touch Technologies Limited	12-May-22	4.7	3.49
Vaxtex Cotfab Limited	19-Apr-22	45	38.18
E2E Networks Limited	12-Apr-22	15.5	15.55
Avro India Limited	07-Apr-22	1	-5.48
Sonam Clock Limited	07-Apr-22	-4.88	-11.36
Debock Industries Limited	31-Mar-22	-0.33	-10.92
MITCON Consultancy & Engineering Services Limited	17-Mar-22	0.56	-10.62
Priti International Limited	02-Mar-22	1	-10.89
Softtech Engineers Limited	25-Feb-22	10.5	-5.35
Dev Information Technology Limited	15-Feb-22	13.67	14.57
Crown Lifters Limited	08-Feb-22	4.22	1.36
Wonder Fibromats Limited	17-Jan-22	5.28	8.13
Uniinfo Telecom Services Limited	12-Jan-22	5.26	8.37
Brand Concepts Limited	11-Jan-22	11.67	15.16
United Polyfab Gujarat Limited	31-Dec-21	5	-5.99
HEC Infra Projects Limited	30-Dec-21	-5.67	-10.84
Jet Freight Logistics Limited	21-Dec-21	-21.6	-12.58
Zodiac Energy Limited	14-Dec-21	1	4.76
Rajshree Polypack Limited	26-Nov-21	5.83	28.11
Focus Lighting and Fixtures Limited	24-Nov-21	1.2	2.43
Marshall Machines Limited	22-Nov-21	-3.57	-6.26
Laxmi Cotspin Limited	12-Nov-21	7.88	17.84
Sikko Industries Limited	22-Oct-21	35	44.34
Art Nirman Limited	18-Oct-21	10.53	17.31
Pansari Developers Limited	18-Oct-21	0.42	6.58
Airo Lam Limited	13-Oct-21	16.94	19.66
Euro India Fresh Foods Limited	12-Oct-21	15.5	13.44
Lagnam Spintex Limited	30-Sep-21	-7	-0.17
Shanti Overseas (India) Limited	16-Sep-21	5	12.01
Par Drugs and Chemicals Limited	16-Sep-21	-5	-2.36
Servotech Power Systems Limited	02-Sep-21	0.63	0.16
Nandani Creation Limited	02-Sep-21	1.36	-4.26
Ganga Forging Limited	06-Jul-21	4.5	5.13
Hindcon Chemicals Limited	05-Jul-21	-20	-19.97
Moksh Ornaments Limited	21-May-21	5	2.38
Ajooni Biotech Limited	07-May-21	2.69	0.07
Tembo Global Industries Limited	23-Apr-21	0.88	-1.78
Nitiraj Engineers Limited	22-Apr-21	1.67	-0.13
Arvee Laboratories (India) Limited	22-Mar-21	1.11	-1.42
Silgo Retail Limited	03-Mar-21	6.96	5.79
Iris Clothings Limited	22-Feb-21	3.54	3.44
AKG Exim Limited	16-Feb-21	7.58	4.53
Rajnandini Metal Limited	16-Feb-21	20	16.79

Name of the Scrip	Migration Date	Return Post Migration (in %)	Total Return (in %)
Ahlada Engineers Limited	28-Jan-21	4.38	2.16
Wealth First Portfolio Managers Limited	20-Jan-21	-0.92	-2.93
Godha Cabcon & Insulation Limited	24-Dec-20	0.4	1
Mangalam Global Enterprise Limited	23-Dec-20	0.31	0.21
RKEC Projects Limited	18-Dec-20	0	-2.35
Rudrabhishek Enterprises Limited	14-Dec-20	127.07	129.13
Accuracy Shipping Limited	11-Dec-20	-13.75	-17.06
Global Education Limited	07-Dec-20	1.79	-0.75
Supreme Engineering Limited	04-Dec-20	3.86	2.82
Marine Electricals (India) Limited	02-Dec-20	19.67	22.44
Dangee Dums Limited	13-Nov-20	11	6.06
Keerti Knowledge and Skills Limited	13-Nov-20	10	3.87
Aaron Industries Limited	06-Nov-20	20	20.47
D. P. Abhushan Limited	03-Nov-20	20	18.4
Banka BioLoo Limited	29-Oct-20	20	24.02
Bombay Super Hybrid Seeds Limited	28-Oct-20	5	0.48
Shradha Infraprojects Limited	22-Oct-20	20	18.02
Suumaya Lifestyle Limited	19-Oct-20	12.28	9.23
Ice Make Refrigeration Limited	12-Oct-20	2.18	-0.87
Globe Textiles (India) Limited	07-Oct-20	20	8.51
Sintercom India Limited	07-Oct-20	-5	-2.41
Aakash Exploration Services Limited	29-Sep-20	955.56	958.15
Tirupati Forge Limited	04-Aug-20	0.48	2.54
Silly Monks Entertainment Limited	08-Jul-20	190.9	191.43
Univastu India Limited	22-Jun-20	3.09	4.18
Kapston Facilities Management Limited	27-May-20	565.56	568.15
Vertoz Advertising Limited	14-May-20	4.09	5.18
Mittal Life Style Limited	29-Apr-20	20	18.31
Touchwood Entertainment Limited	21-Jan-20	3	4.02
Vaishali Pharma Limited	15-Jan-20	13.21	10.41
Panache Digilife Limited	06-Jan-20	-8.91	-9.79
Jash Engineering Limited	30-Oct-19	6.56	13.44
Creative Peripherals and Distribution Limited	05-Aug-19	-6.35	1.38
Shrenik Limited	02-Aug-19	24.02	17.61
Sumit Woods Limited	30-Jul-19	10.23	-108.73
Libas Designs Limited	23-Jul-19	7.28	-52.63
Sirca Paints India Limited	22-Jul-19	6.77	19.35
Sanginita Chemicals Limited	15-Jul-19	6.72	70.33
InfoBeans Technologies Limited	15-Jul-19	4.90	6.60
Steel City Securities Limited	27-Jun-19	51.14	-84.25
One Point One Solutions Limited	09-May-19	53.30	-261.11
Airan Limited	03-May-19	53.36	-145.23
South West Pinnacle Exploration Limited	18-Apr-19	53.27	-42
Maheshwari Logistics Limited	15-Apr-19	-3.21	73.85

Name of the Scrip	Migration Date	Return Post Migration (in %)	Total Return (in %)
Sakar Healthcare Limited	11-Apr-19	8.41	23.70
Agro Phos India Limited	08-Mar-19	-53.15	78.86
Sagardeep Alloys Limited	25-Jan-19	38.55	65.51
Hi-Tech Pipes Limited	07-May-18	57.35	71.61
Sanco Industries Limited	22-Nov-16	84.11	-7.46
Veto Switchgears And Cables	29-Apr-15	35.29	0.99

Source: Own study.

To test if there is a significant improvement in Return after Migration in selected firms, the overall and after returns are correlated with the hypothesis of:

H_0 : There is a negligible gap in the return of selected companies after the migration.

The independent sample t-test is used with SPSS-19 tools to evaluate the aforementioned hypothesis and the findings are as follows (Table 2):

Table 2: Independent Sample T-Test

		VAR1	N	Mean	Std. Deviation	Std. Error Mean				
Return Post Migration	Pre		107	25.7124	108.77213	10.51540				
	Post		107	18.5668	115.35577	11.15186				
Independent Samples T-Test										
		Levene's Test		Means Equalities						
		F	Sig.	t	df	Sig.	MD	SE	95% Confidence	
Return Post Migration	Equal variances assumed	.029	.864	.466	212	.642	7.14561	15.32768	-23.06857	37.35978
	Equal variances not assumed			.466	211.272	.642	7.14561	15.32768	-23.06917	37.36038

Levene's Test is used to measure whether Equality of Variances is not significant and thus the equal variance assumed row is selected for the test. The results revealed an insignificant difference in the Post Migration Return of the securities, as $t_{(212)}=0.466$ which is >0.05 ($P=0.05$).

CONCLUSIONS

Businesses, specifically, those who have got the chance to establish a brand for their business after the launch of SME Exchange. Through this study, we will observe that SMEs do have the potential to expand and establish themselves like mainboard businesses across this forum. They do have the ability to develop ethically, get prepared, and build jobs for the country. Until 2012, due to the non-availability of networks, they encountered problems related to finance, as they were unable to expand and evolve.

We note that the disparities between post migrations returns have not improved significantly, suggesting that migration does not enhance the return capabilities of the selected companies. We found no substantial increase in the discrepancies between post-migration returns, meaning that

migration will not strengthen the return capabilities of the companies chosen for the report. We have noted there is a huge rise in business income.

By giving Small and Medium Enterprises (SME) firms the option to choose a premium listing on the National Stock Exchange (NSE), it creates an environment to examine the direct impacts of implementing enhanced corporate governance and transparency practices. Our analysis reveals a consistent pattern: when a corporation opts for a main board (NSE) listing, its shares often generate a favourable anomalous return although it was not found significant.

RECOMMENDATIONS

Opting for a premium listing, results in a substantial surge in the trading volume of non-voting shares, which is why companies choose a premium listing that adheres to the most stringent criteria. Companies that choose for a premium listing often have prospects for expansion that they fund via future seasoned stock issues. However, our findings indicate that not every firm can achieve this, since a premium listing serves as a means to establish a connection with enhanced

corporate conduct, which may be more cost-effective than cross-listing on the NSE market. Furthermore, opting for a premium increases the trading volume of non-voting shares, in line with the idea that enhanced transparency leads to greater liquidity. The significance of these implications lies in their ability to substantiate the efficacy of privately creating premium listings in enhancing investor well-being and fostering the growth of capital markets. Furthermore, it provides an opportunity the company to further raise their common stock and list them on a premium listing that is often at higher prices.

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FIRM'S SUSTAINABILITY AND PERFORMANCE: CRITICAL INSIGHTS FROM BIBLIOMETRIC REVIEW AND CONTENT ANALYSIS

Sarandeep Kaur*, Kapil Gupta**

Abstract *The concept of sustainability has gained paramount importance in business, economic, and financial literature. Despite numerous research studies being conducted on the relationship between firm's sustainability and performance, there is still a paucity of a comprehensive review on this topic. Hence, a bibliometric analysis of 1183 articles have been conducted with an aim to identify research gaps and propose the scope for future research. Data retrieved from SCOPUS and Web of Science has been screened using PRISMA framework. The study focusses on comparative analysis, performance analysis, and scientific mapping of sorted data. The results suggest a growing interest of academicians in sustainability. Additionally, co-word analysis has been conducted to ascertain frequently used words in the literature. Furthermore, content analysis has been conducted for highly cited documents to identify prominent theories guiding the relationship and preferred parameters of both sustainability and performance. This study would be helpful for aspiring researchers in understanding the historical background, the advancements and comprehending the idea.*

Keywords: *Bibliometric Analysis, Content Analysis, ESG, Firm's Performance, Sustainability*

JEL Classification: *C88, L21, L25, M14, Q56*

INTRODUCTION

Since no business can operate entirely on its own and depends on society to meet its requirements, therefore, it has a moral obligation to pay back to society. This implies that a business must give due consideration to environment and society while making efforts to earn high profits (Tai & Chuang, 2014). Hence, creating value for all stakeholders holds equal importance. Kaplan (2023) also asserts that besides maximising profits, creating value for all stakeholders is the company's primary objective. Therefore, every business organisation is expected to behave as a 'better citizen' (Orsato, 2006) besides being profitable. Gao et al. (2021) also propagates that an organisation's overall strength relies more on Environment, Social, and Governance (ESG) and sustainable development and is not restricted to high profitability and market value. Accordingly, there is a shift in investor preferences, as they are now interested in sustainable businesses (Bocken, 2015) besides organisations, traditionally being evaluated based on their accounting

(Mandal & Mitra, 2023) and market performance (Eccles et al., 2012).

The term 'sustainable business' has been defined differently across the literature (Lian & Lim, 2023; Soepe, 2004) over the years. Initially, its focus lies on environment consciousness with the goal of minimising adverse impacts of business operations on the environment, such as pollution, climate change, and carbon emissions. This was followed by the introduction of Corporate Social Responsibility (CSR), which focuses on organisations' responsibility towards society as a whole, i.e., a combination of environmental and social concerns (Singh et al., 2021). Sturdivant and Ginter (1977) propagated that firms with more CSR activities outperform those with low or no CSR activities. However, many companies failed, and the Cadbury Report (1992) identified poor governance as a major reason for their failure, therefore stimulate need to include good governance policy in business resulting in implementation of a holistic strategy of ESG in business. Soon in 1994, John Elkington introduced Triple Bottom Line (TBL) approach, which corresponds to

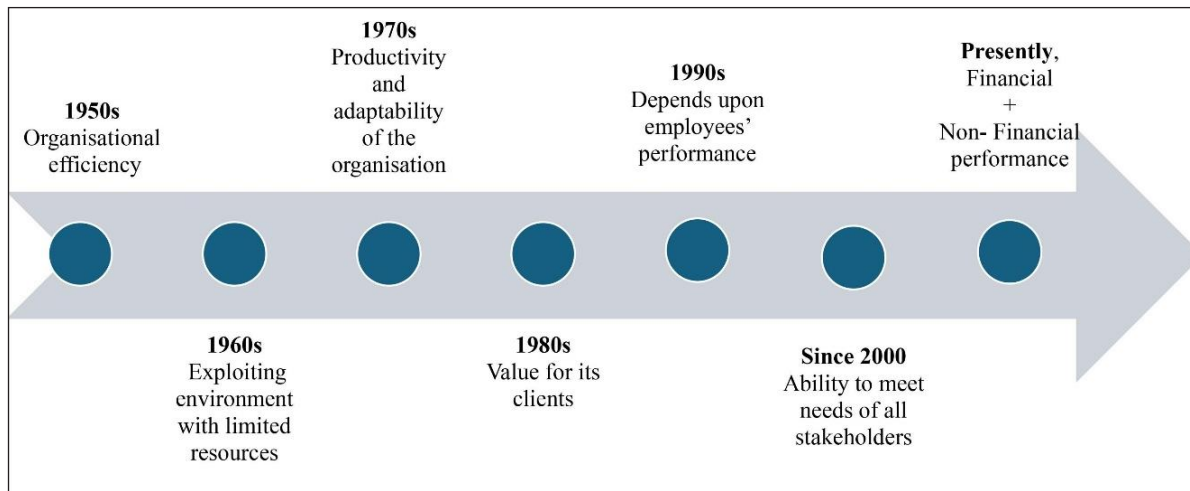
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Sustainable Development as coined by the United Nations Brundtland Commission in 1987. TBL focusses on three major parameters of corporate sustainability: Economical (Profits), Social (People), and Environment (Planet), as discussed in the literature¹.

Joseph (2016) stated a firm is believed to have performed well if it has achieved aforementioned parameters in an

anticipated way, i.e., by fulfilling needs of each stakeholder. Accordingly, sustainable business organisations derive benefits from their actions, which indicates a significant correlation between the business's sustainability and performance. Firm performance is a broad term, which opted different connotations over the years. Fig. 1 provides a concise overview of its evolution.



Source: Compiled by author considering explanation for Firm Performance by Taouab, O., & Issor, Z. (2019).

Fig. 1: Growth in the Concept of Firm's Performance

Initially, firm value was considered equivalent to operational performance (evaluated in terms of organisational efficiency). Subsequently, its focus shifted to exploitation of environment with limited resources in 1960s. In 1970s, firm performance was measured considering its productivity, adaptability and efficiency. However, Freeland (1975) highlights importance of increasing customer value to improve corporate profitability, thus, changed computation measure of business performance to value delivered to clients in 1980s. Later, in 1990s, it expanded its ambit to include other categories of stakeholders and was subsequently associated with the efficiency of employees. This highlighted significance of all stakeholders as key drivers of firm performance (Bassioni et al., 2005) hence emphasising on business's adherence to Stakeholder Theory of Ethics (Richter & Dow, 2017) for enhancing its performance. Haigh and Hoffman (2011) propagated that competition now-a-days is not restricted to the quality of goals and services but also on its impact on society and the environment. Recently, the definition of a company's performance expanded and now includes both financial and non-financial performance (Agostini et al., 2022; Taouab & Issor, 2019). Additionally, Sharma

et al. (2019) and Haigh & Hoffman (2011) emphasise that sustainability driven organisations enjoy competitive advantage, indicating its positive association with organisational performance (Majeed, 2011).

Kumar et al. (2016) highlighted 'firms meeting ESG criteria generally exhibit less volatility thereby denting risk while still having higher returns. Consequently, several authors analysed the relationship between sustainability or ESG and firm value (market performance) (Abdi et al., 2020). Since, sustainability is not limited to affect market performance (firm value), it rather affects all aspects of business operations. Accordingly, researchers expand their purview by considering other dimensions of performance along-with firm value, thus, considering the relationship between sustainability performance and firm's overall performance (Hoang et al., 2020). Moreover, literature clearly demonstrates the concept's extensive exploration since 2010 though it has been introduced since the last decades of 20th century.

Despite numerous research studies being conducted on the relationship between firm's sustainability and performance

¹ Please see Bozesan (2016); Smith (2016); Soto-Acosta et al. (2016)

over the past two decades, only two studies have been found with comprehensive review of related literature². Therefore, this study incorporates dual analytical approach, involving bibliometric analysis and content analysis of scholarly publications to analyse both historical and contemporary patterns. The article comprises several sections: *Section 2* outlines the need of conducting study, *Section 3* limns the methodology employed, *Section 4* focusses on conclusions drawn from results of analysis and *Section 5* provides scope for future work.

NEED OF THE STUDY

Wahyuningrum et al. (2023) propounded 'sustainability reporting and performance' being prominent theme associated with environmental sustainability. Recently, numerous studies have been conducted on the relationship between sustainability and firm's performance (Kumar et al., 2022) or ESG and firm's value³ or sustainability and firm's value (Abdi et al., 2020). Scholars claimed that bibliometric analysis is one of the best ways to effectively highlight

dominant themes and new research directions in a field of study⁴. Furthermore, it has been observed from accessible literature that majorly studies conducted bibliometric analysis on the holistic approach of firm's sustainability (Meseguer-Sánchez et al., 2021), its related strategies (Kitsios et al., 2020) and its relationship with risk (Nobanee et al., 2021). However, few studies examined the literature on sustainability and various aspects of firm's performance (Park, 2023). Therefore, the need arouses to explore and analyse the related literature to acquire a broader perspective and comprehend the history of underlying subject prior to conducting research.

Since, this study summarises the pertinent information and inferences to aid aspiring researchers in comprehending the idea, identifying research gaps, and utilising their valuable time that ordinarily be consumed in retrieving information to understand the historical background, recent advancements, and interconnections between themes across different related publications. Consequently, five underlying research questions guiding this review of literature have been finalised (Fig. 2).



Source: The authors.

Fig. 2: Research Questions

MATERIALS AND METHODS

This study has been completed in three stages categorised as: data retrieval, data sorting, and data analysis.

² Please see Atz et al.(2023); Khan (2022)

³Please see Behl et al. (2021); Brooks & Oikonomou (2018)

Data Retrieval

For data retrieval for bibliographic research, SCOPUS and Web of Science (WoS) have been selected as databases on being relatively advantageous as compared to other

⁴Please see Abdullah et al. (2023); Bota-Avram (2023)

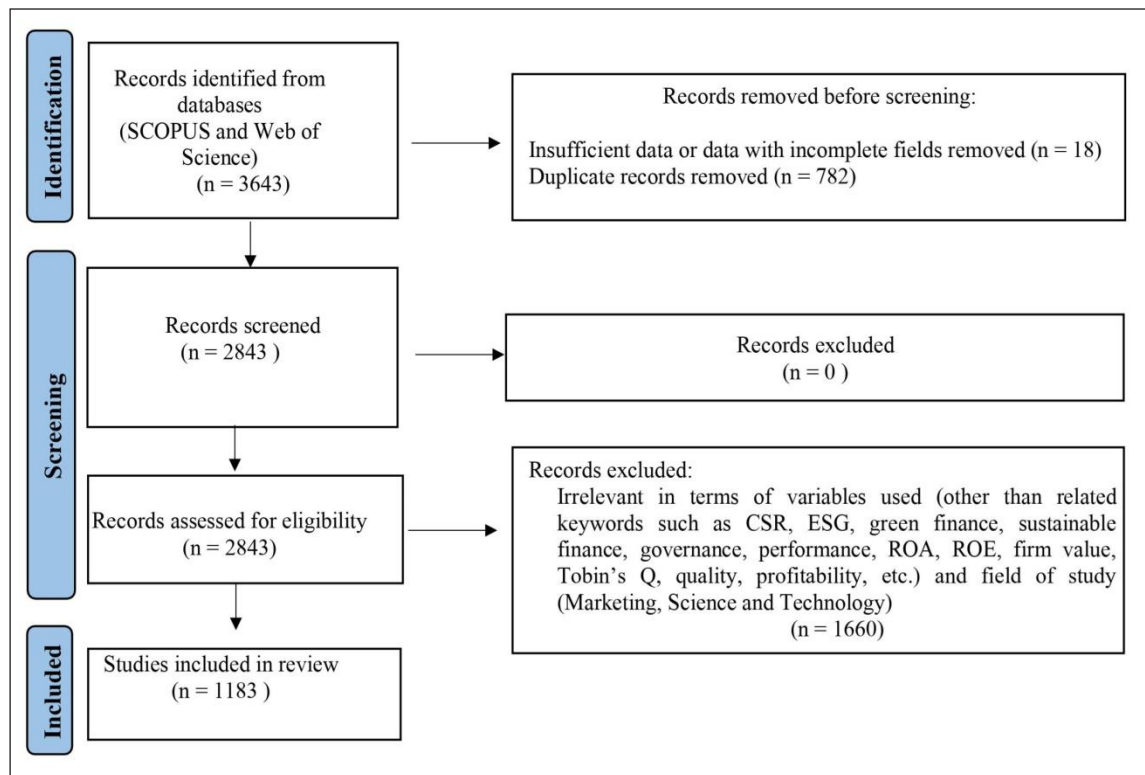
databases and having wider coverage in social sciences (De Giuli et al., 2023). Moreover, these two databases are readily accessible. SCOPUS is preferred because of the convenience in exporting data (Gao et al., 2021) whereas WoS is preferred for catering to the needs of a wide spectrum by providing exhaustive data, though it features only selected number of journals (Sánchez-García et al., 2023).

Databases were explored on April 26, 2023, to obtain publications using keywords: ‘ESG’, ‘sustainability’, ‘green finance’, ‘firm performance’ and ‘firm value’ with preferred language: ‘English’ and time frame under study: ‘Since

2000’. A total of 3643 publications were retrieved from the databases.

Data Sorting

Four separate CSV files were obtained two from SCOPUS and two from WoS, subsequently merged and then underwent screening through Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, a widely accepted and a standard procedure for screening and refining in academia (Kumar & Gupta, 2023; Sánchez-García et al., 2023).



Source: The authors.

Fig. 3: PRISMA Screening of Documents

Fig. 3 exhibits a process of obtaining the final dataset (1183 publications) after eliminating duplicate papers, papers with inadequate information, and irrelevant studies. It encompassed studies conducted between 2009 and 2023.

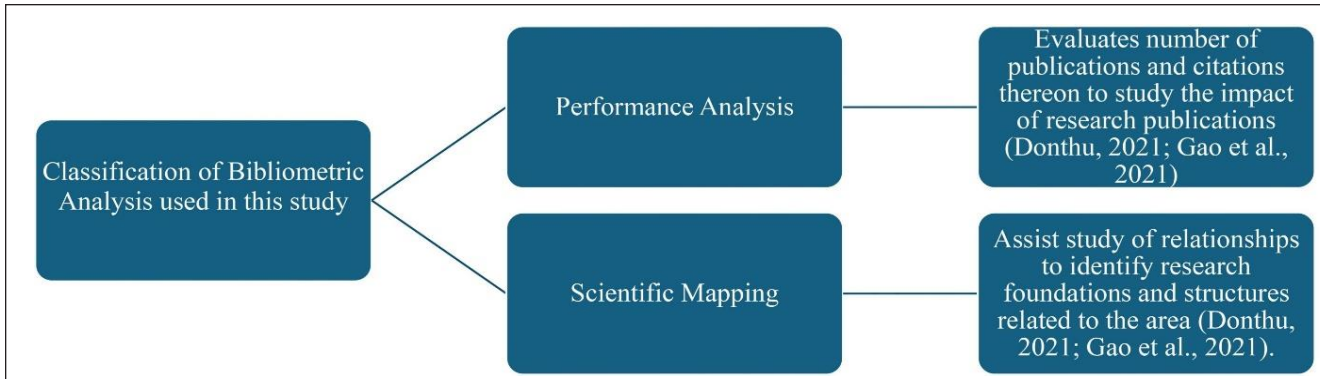
Data Analysis

Sorted data has been analysed using Bibliometric Analysis and Content Analysis.

Bibliometric Analysis

Bibliometrics is an analysis introduced by Alan Pritchard in 1969 (Roig-Tierno et al., 2017) for measurements of published documents (Osareh, 1996). De Giuli et al. (2023) propagated its importance as a tool of literature review in recent times.

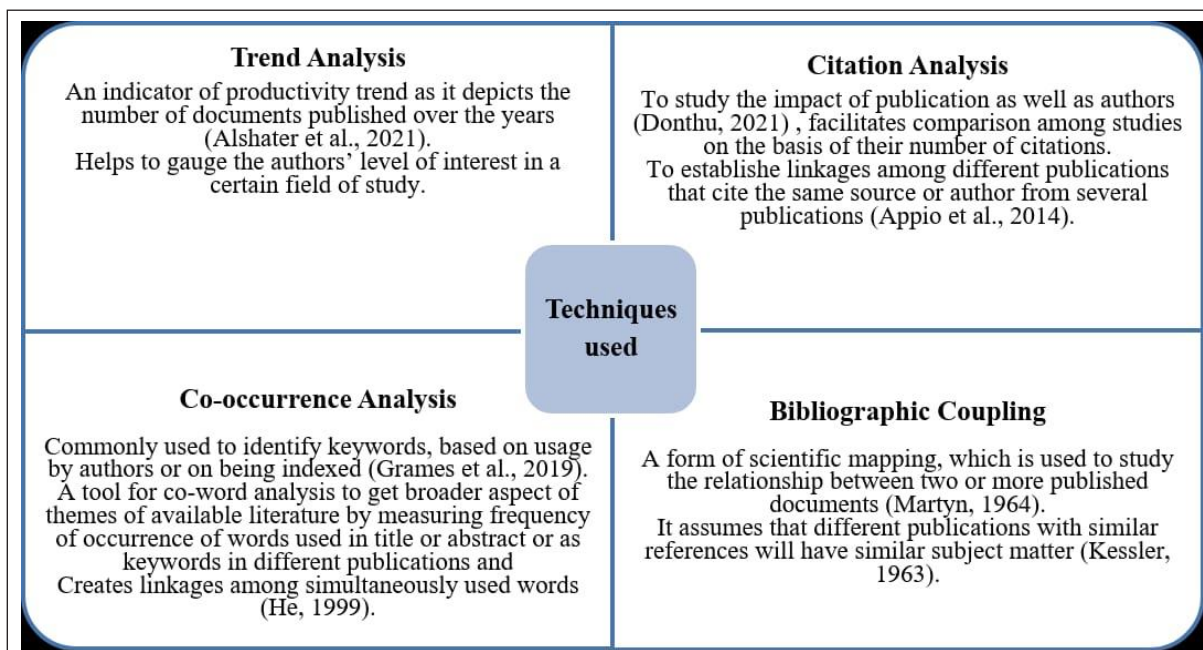
Fig. 4 illustrates various forms of bibliometric analysis used in this study.



Source: The authors.

Fig. 4: Classification of Bibliometric Analysis

To accomplish the study’s purpose, four data analysis techniques have been employed (Fig. 5).



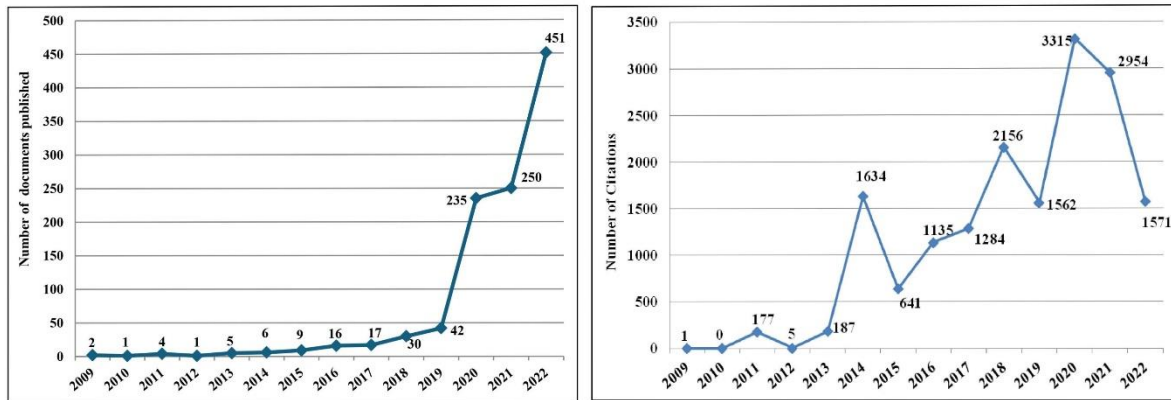
Source: The authors.

Fig. 5: Techniques of Bibliometric Analysis Used

Publication Trends

For analysing the publication trends, we purposefully omitted data from 2023, as presenting data for a few months of

2023 would result in an unbalanced distribution. It has been performed using MS-Excel to ascertain periodic fluctuations in the number of papers and citations thereon from 2009 to 2022 in the underlying subject and depicted in Fig. 6.



Source: The authors.

Fig. 6: Trends of Publications and Citations

Fig. 6 demonstrates an upward trend for the number of documents published which indicates an increase in publications over the time. It demonstrates a gradual increase in the number of relevant studies since 2016 and in the number of citations for studies until 2020, attaining a peak (3315 citations) for published documents in 2020.

It clearly indicates a substantial rise in the number of studies conducted over the past three years (since the COVID outbreak). Moreover, 451 out of 1069 studies (42.19%) have been published in 2022. Furthermore, more than fivefold rise in the number of documents published in a year (42 in 2019 to 235 in 2020) is observed. This increase in research

is a sign of a concept’s gaining academic appeal (Aras & Crowther, 2008; Soppe, 2004).

Most Influential Publications

Since, published literature serves as foundation for future research (Snyder, 2019; Zhang et al., 2019), an attempt has been made to identify highly cited documents. Table 1 has been created using MS-Excel to display influential publications (14 studies), each with a minimum of 150 citations.

Table 1: List of Most Influential Publications

Title	Year	Journal	No. of Citations
Corporate social responsibility and access to finance.	2014	Strategic Management Journal	1404
Green R&D for eco-innovation and its impact on carbon emissions and firm performance.	2015	Journal of Cleaner Production	290
The effects of environmental, social, and governance disclosures and performance on firm value: A review of literature in accounting and finance.	2018	British Accounting Review	262
Firms and social responsibility: A review of ESG and CSR research in corporate finance.	2021	Journal of Corporate Finance	257
The impact of environmental, social, and governance disclosure on firm value: The role of CEO power.	2018	British Accounting Review	256
Corporate social responsibility governance, outcomes, and financial performance.	2017	Journal of Cleaner Production	240
Corporate social responsibility and financial performance: A non-linear and disaggregated approach.	2016	Economic Modelling	236
Do environmental, social, and governance activities improve corporate financial performance?	2019	Business Strategy and the Environment	226
Do ESG controversies matter for firm value? Evidence from international data.	2018	Journal of Business Ethics	204

Title	Year	Journal	No. of Citations
Corporate immunity to the COVID-19 pandemic.	2021	Journal of Financial Economics	199
Business sustainability performance and cost of equity capital.	2015	Journal of Corporate Finance	187
Green practices and financial performance: A global outlook.	2017	Journal of Cleaner Production	184
Green entrepreneurial orientation for enhancing firm performance: A dynamic capability perspective.	2018	Journal of Cleaner Production	179
Environmental, Social and Governance (ESG) scores and financial performance of Multilatinas: Moderating effects of geographic international diversification and financial slack.	2021	Journal of Business Ethics	159

Source: The authors.

Table 1 reveals that the highest-cited studies have been conducted after 2013, and 50% of articles have been published during 2018 (4 articles) and 2021 (3 articles). Four highly-cited articles are published in ‘Journal of Cleaner Production’ with a total of 893 citations, thereby indicating that it has published articles of high quality.

Country-Wise Analysis

This section comprises an analysis of articles based on countries contributing to research in similar aspects and countries with high quality research. It will assist the potential authors to know the performance of their own country and the scope of further research in their country in this field of research. A total of 98 countries around the world have at least one published article on the relationship under study.

Leading Countries in Research

Among the 98 identified countries, the top 21 countries, each with a minimum of 20 documents are enlisted in descending order of the number of documents published in Table 2.

Table 2: List of Most Productive Countries

Country	No. of Documents
China	147
United States	140
India	105
United Kingdom	100
Malaysia	81
Australia	60
South Korea	54
Pakistan	53
Italy	51
Indonesia	50
France	46
Vietnam	46

Country	No. of Documents
Spain	45
Canada	42
United Arab Emirates	36
Germany	35
Taiwan	35
Saudi Arabia	28
Tunisia	28
Turkey	26
Bahrain	20

Source: The authors.

China is leading among 21 countries in addressing the total number of publications on the underlying issue (Table 2). Remaining four among top five countries are the United States, India, United Kingdom and Malaysia. It is worth noting that among these 21 countries, 11 are developed countries (Table 2), which suggests that developed nations have published more than 50% of the world’s total published documents.

Table 3 enlists the top 19 countries (around 19.39% of the total 98 countries), with a minimum of 300 citations on published documents, arranged in descending order of number of citations. It also comprises of results of average citations per document (AC/D) with an objective to analyse the quality of publications produced by a country.

The United States ranks first with 4299 citations on its published documents, followed by the United Kingdom with 3643 citations. However, the level of research conducted in Belgium and the United Kingdom is quite high as Belgium has the highest AC/D, followed by the United Kingdom. Moreover, the majority of these countries (12 out of 19 countries) are developed countries, thereby indicating their contribution to high calibre research.

Table 3: List of Leading Countries

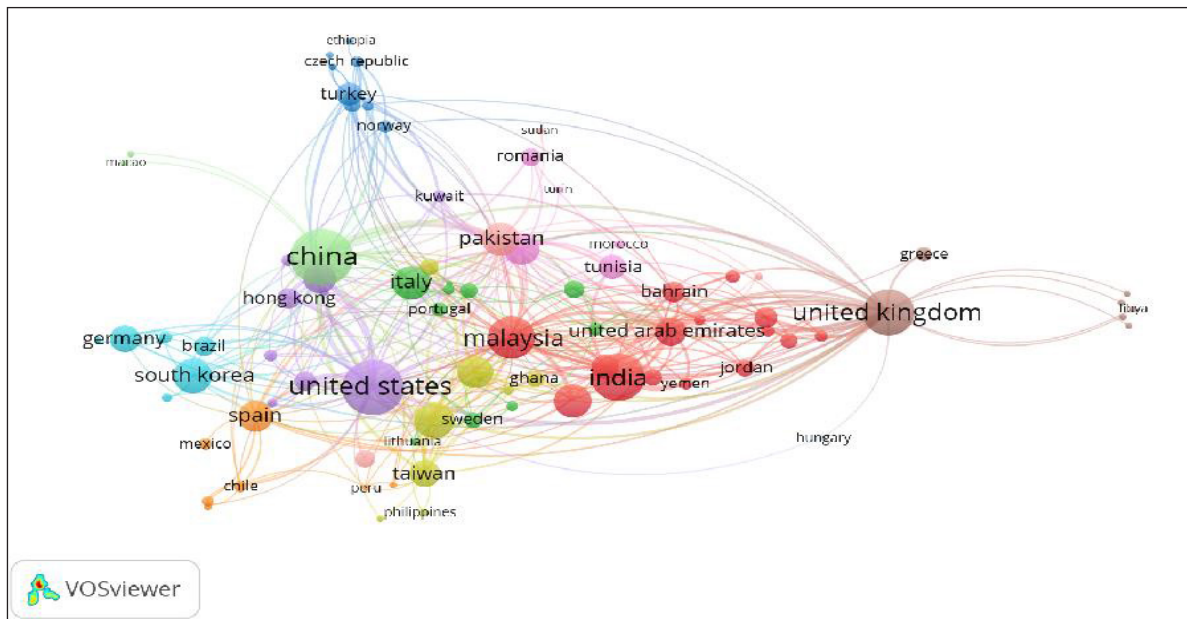
Country	No. of Citations	AC/D
United States	4299	30.71
United Kingdom	3643	36.43
China	1541	10.48
Australia	1453	24.22
Germany	1208	34.51
France	1201	26.11
Italy	1150	22.55
Malaysia	1046	12.91
Spain	878	19.51
India	517	4.92
Pakistan	505	9.53
Canada	446	10.62
Netherlands	436	24.22
Hong Kong	407	21.42
Turkey	390	15
Belgium	333	83.25
Taiwan	304	8.69
Egypt	302	15.89
Vietnam	302	6.57

Source: The authors.

Table 2 and Table 3 together reveal that Belgium though not included in the list of countries with the most published documents, it has maximum AC/D among countries with a minimum of 300 citations. Moreover, United Kingdom ranks second regarding both the total number of citations and the AC/D (36.43); however, it has a relatively lower number of publications (100).

Country Bibliographic Coupling

Bibliographic coupling among countries indicates similarities in the research conducted in different countries around the globe. Using VOSviewer, a network diagram of countries (Fig. 7) has been generated, comprising nodes of varying size and colours to represent different countries, where its size indicates the number of published documents. Larger the node, more the documents published for a country. Its colour represents the similarity of countries’ objectives and keywords, and identically coloured nodes collectively form a clusters for countries with publications on related research areas and common citations (Gao et al., 2020).



Source: The authors.

Fig. 7: Network Visualisation Representing Countries

Journal-Wise Analysis

This section offers an in-depth journals-based review as to assist the potential authors in identifying suitable journals containing related research articles. The analysis suggests there are 396 journals with minimum one published article

on underlying subject matter.

Most Productive Journal

Table 4 enlists the top 15 journals in descending order of their total number of published documents (minimum 10 published articles).

Table 4: List of Most Productive Journals

Journal	No. of Documents	Publisher
Sustainability	86	MDPI Open Access Publishing
Business Strategy and the Environment	28	Wiley-Blackwell
Journal of Cleaner Production	25	Elsevier
Corporate Social Responsibility and Environmental Management	24	Wiley-Blackwell
Corporate Governance (Bingley)	20	Emerald Publishing
Finance Research Letters	19	Elsevier
Cogent Business and Management	19	Cogent Open Access
Journal of Asian Finance, Economics and Business	14	Korea Distribution Science Association (KODISA)
Corporate Governance: An International Review	14	Wiley-Blackwell
Economic Research-Ekonomska Istrazivanja	13	Taylor & Francis
International Journal of Disclosure and Governance	13	Springer Nature
Journal of Business Ethics	12	Springer Nature
Sustainability Accounting, Management and Policy Journal	12	Emerald Publishing
Global Business Review	10	SAGE

Source: The authors.

Table 4 depicts that 183 out of total 320 articles (57.19%) of the top 15 journals are published in the top 5 journals, which are ‘Sustainability’, ‘Business Strategy and the Environment’, ‘Journal of Cleaner Production’, ‘Corporate Social Responsibility and Environmental Management’ and ‘Corporate Governance (Bingley)’. It is evident that out

of the top 5 journals, ‘Sustainability’, a Switzerland-based journal, ranks first in number of publications with 86 out of 183 published articles (46.99%).

Table 5 enlists the top 15 journals (each with at least 200 citations) in a descending order of number of citations.

Table 5: List of Most Influential Journals

Journal	No. of Citations	AC/D
Strategic Management Journal	1601	228.71
Journal of Cleaner Production	1386	55.44
Business Strategy and the Environment	1036	37.00
Sustainability (Switzerland)	1022	11.88
Journal of Business Ethics	687	57.25
Corporate Social Responsibility and Environmental Management	580	24.17
Journal of Corporate Finance	578	82.57
British Accounting Review	556	185.33
Economic Modelling	244	81.33
Management of Environmental Quality: An International Journal	227	45.40
Global Finance Journal	216	27.00
Corporate Governance (Bingley)	215	10.75
International Journal of Production Economics	208	34.67
Journal of Financial Economics	202	67.33
International Journal of Accounting and Information Management	200	28.57

Source: The authors.

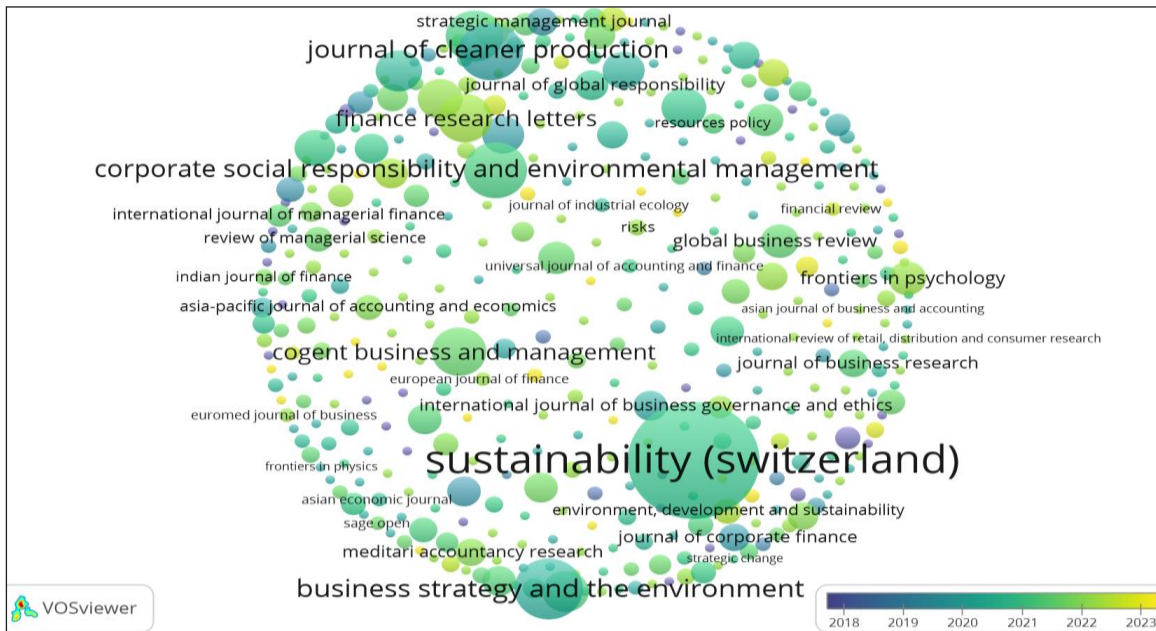
It is worth noting from Table 5 that ‘Strategic Management Journal’ (Wiley-Blackwell Publishing and ‘A*’ rating in ABDC Journal Quality List) publishes the most cited publications (total 1601 citations). Despite not being included in the list of the most productive journals (number of articles < 10), it holds the top position as AC/D, thereby, indicates that it comprises publications of exceptional quality.

On collectively reviewing Table 4 and Table 5, it has been identified that ‘Journal of Cleaner Production’ (an Elsevier

publication with an ‘A’ rating in the ABDC Journal Quality List), appears on both lists. Thus, indicating its prominence of having high productivity in terms of documents published (25 articles) besides its distinction of being one of the most cited journals (1386 citations).

Journal Overlay Visualisation

A visual presentation of the journals (Fig. 8) has been generated using VOSviewer to enhance understanding.



Source: The authors.

Fig. 8: Journals Overlay Visualisation

It is evident that ‘Sustainability’ is the most popular journal with the most published documents, as represented by the largest node (Fig. 8). The colour of its node indicates that it is a preferred journal after 2020. However, several new journals are publishing recently, among which ‘International Review of Economics and Finance’, is the most popular in 2023. Since 2022, ‘Finance Research Letters’ has also been publishing articles on underlying relationship.

Author Wise Analysis

This section provides results of authors-based analysis for various available published articles. Future researchers would be able to discover renowned authors working on this topic.

Most Productive Authors

The dataset consists of 2093 authors who contributed minimum one paper associated with the firm’s sustainability and performance. Table 6 enlists 14 authors with a minimum of four publications.

Table 6: List of Most Productive Authors

Authors	No. of Documents
Buallay, A.	12
Hussainey, K.	10
Kim, S.	10
Ali, S.	8
Rezaee, Z.	6
Velte, P.	6
Tabash, M.I.	5
About, A.	5
Bodhanwala, R.	5
Lee, J.H.	5
Lee, J.	5
Hashim, H.A.	4
Tran, Q.T.	4
Al-Faryan, M.A.S.	4

Source: The authors.

Table 6 demonstrates that Buallay A. is the author with the maximum number of published documents. Besides Hussainey, K., Kim, S., and Ali, S. are the most productive authors. These authors contributed to 40 out of 89 articles (44.94%) by the top 14 authors in the underlying topic.

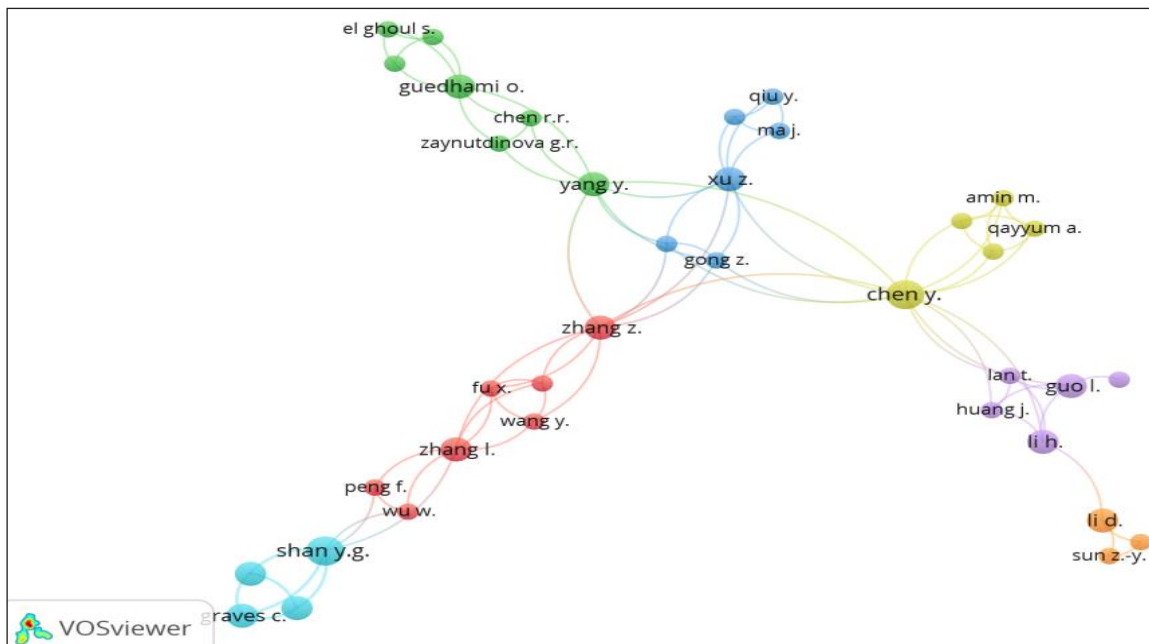
Table 7: List of Most Influential Authors

Authors	No. of Documents	No. of Citations	AC/D
Serafeim, G.	3	1519	506.33
Ioannou, I.	1	1404	1404.00
Cheng, B.	2	1404	702.00
Rezaee, Z.	6	417	69.50
Lee, K.H.	2	407	203.50
Min, B.	1	290	290.00
Zhang, X.	3	269	89.67
Oikonomou, I.	1	262	262.00
Brooks, C.	1	262	262.00
Gillan, S.L.	1	257	257.00
Koch A.	1	257	257.00
Starks, L.T.	1	257	257.00

Authors	No. of Documents	No. of Citations	AC/D
Koh, L.	1	256	256.00
Li, Y.	1	256	256.00
Gong, M.	1	256	256.00
Zhang, X.-Y.	1	256	256.00
Hussainey, K.	10	243	24.30
Sarkis, J.	1	240	240.00
Wang, Z.	1	240	240.00
About, A.	5	239	47.80
Nollet, J.	1	236	236.00

Source: The authors.

Table 7 indicates that the top 1% of authors have a minimum 236 citations. Serafeim, G., is the most cited author with 1,519 citations on a total of 3 articles (AC/D: 506.33). On an average, each of the above listed authors has AC/D over 20; thereby indicating that their work is of the utmost quality. Besides Ioannou, I., Cheng, B., and Serafeim, G. also produced high-quality work, with AC/D > 500. Additionally, these authors share a common article. About, A., Rezaee, Z., and Hussainey, K., are only authors with a minimum of five publications and higher citations thereon.



Source: The authors.

Fig. 9: Network Visualisation Representing Authors

Fig. 9 portrays a network (comprising seven clusters) of authors who have contributed to this field.

Co-Word Analysis

Co-word analysis has been conducted to identify key terms and preferred research areas.

Keyword Co-Occurrence

While conducting Keyword co-occurrence analysis, 3072 keywords were identified. Approximately 1% of these keywords (31 keywords) have been enlisted in Table 8 in descending order of their frequency of occurrence.

Table 8: List of Keywords

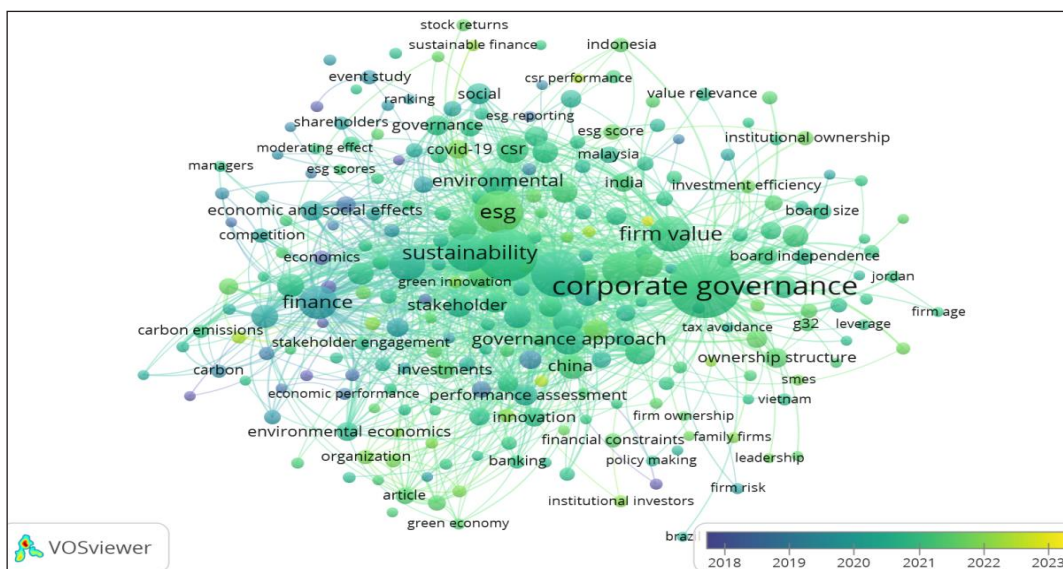
Keywords	Occurrences	TLS
Corporate governance	449	1143
Financial performance	277	1150
Corporate social responsibility	207	923
ESG	171	638
Sustainability	130	689
Firm performance	109	401
Firm value	106	361
Finance	90	648
Sustainable development	78	503
Governance approach	67	516
Environmental	62	255
CSR	57	237
Industrial performance	47	371
Firm size	47	314
China	45	276
Performance	44	228
Corporate strategy	40	297
Environmental performance	40	227
ESG performance	40	112
Environmental management	39	278
Stakeholder	36	314

Keywords	Occurrences	TLS
Corporate financial performance	36	191
ESG disclosure	36	147
Regression analysis	34	257
Stakeholder theory	34	157
Board of directors	33	107
Earnings management	33	98
Performance assessment	32	258
Stock market	31	248
Social	31	147
Investment	30	218

Source: The authors.

Table 8 reflects that each of these keywords have been repeated at least 30 times. Since word ‘governance’ has been repeated the most (total occurrence: 516 times), it can be considered as preferred component of sustainability. Likewise, financial performance is the most preferred form of firm’s performance. However, the top 10 keywords considering total link strength (TLS) are financial performance, corporate governance, corporate social responsibility, sustainability, finance, ESG, governance approach, sustainable development, firm performance, and industrial performance.

Keyword overlay visualisation (Fig. 10) demonstrates the commonly used keywords in the dataset represented by nodes of various colours and sizes, where the colour indicates the time-period of its usage and the size indicates the number of times it has been used. The larger the node, the greater is the presence of such keyword in the studies.



Source: The authors.

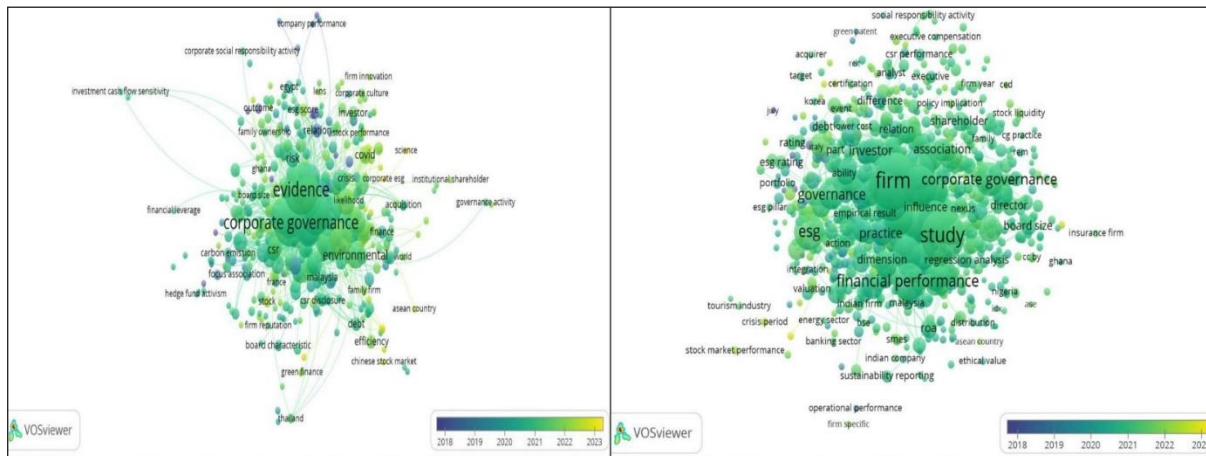
Fig. 10: Pictorial Representation of All Related Keywords Used in Previous Studies

Fig. 10 demonstrates that a significant number of related keywords, viz., corporate governance, corporate social responsibility, financial performance, ESG, sustainability, firm value, and sustainable development are the most popular search terms. It depicts a dense network of variables indicating a close relationship among recent studies. CSR performance, environment social governance (ESG), default risk, machine learning, green innovation, sustainable finance, stock price crash risk, market performance, and

legitimacy theory are repeated keywords in the last few years, particularly 2022 and 2023.

Title and Abstract Based Co-Word Analysis

This section reveals the frequently used words in the titles and abstracts of articles in the sorted dataset. Fig. 11 displays network visualisation of the top 10% of a total of 2127 words in titles and the top 10% of a total of 16084 terms used in abstracts.



Source: The authors.

Fig. 11: Pictorial Representation of Words Frequently Used in Titles and Abstracts

While analysing the dataset, 22 clusters are formed based on frequently occurring words in the titles and 17 clusters based on words in abstracts.

The most prevalent terms in clusters based on titles are corporate governance, financial performance, and evidence. Fig. 11 suggests that since 2022 the most frequently used terms in the titles of related studies are ESG, social, COVID, environmental performance, pandemic, corporate ESG performance, ESG score, sustainability disclosure, stock, market performance, sustainability initiative, and green finance.

Further, the most often appeared words in the abstracts of related studies since later 2021 are ICT, stock market performance, climate, environmental pillar, ESG strategy, stock market reactions, corporate controversy, green firm, mitigating effect, labour investment efficiency, innovative firm, and ESG fund.

Content Analysis

Content analysis is a qualitative tool to conduct a subjective analysis for interpreting the content of text in a systematic manner to gain more comprehensive description (Moldavska & Welo, 2017). Since Tsai et al., (2020) propagated inability

of Bibliometric analysis as a tool of review of literature, Content analysis has also been included in this study. The top 27 articles with minimum of 100 citations forms the dataset, from which 8 were excluded on being review articles or non-empirical. Content of remaining 19 articles has been thoroughly analysed to identify prominent theories, parameters of sustainability, and measures of performance, and results have been enlisted in Table 9, Table 10, and Table 11, respectively.

Table 9: List of Underlying Theories

Theories	Number of Papers	Preference Percentage
Stakeholder Theory	14	73.68
Resource Based View	5	26.32
Legitimacy Theory	4	21.05
Institutional Theory	4	21.05
Agency Theory	3	15.79
Affordability Theory	1	5.26
Trade Off Theory	1	5.26
Attribution Theory	1	5.26
Stakeholder Engagement Theory	1	5.26

Source: The authors.

Different theories have been used across the associated literature (Table 9), among which, Stakeholder Theory is the most prominent theory as the majority of papers (73.68%) have utilised it as an underlying theory.

Table 10: List of Parameters of Sustainability

Parameters of Sustainability	Number of Papers	Preference Percentage
Environment	16	84.21
Social	14	73.68
Governance	12	63.16
Sustainable Finance	1	5.26

Source: The authors.

Table 10 enlists different parameters of sustainability among different studies in descending order of their utilisation. It is evident that Environment is the most focussed parameters of sustainability.

Table 11: List of Measurements of Performance

Performance Measurements	Number of Papers	Preference Percentage
Tobin's Q	10	52.63
ROA	7	36.84
ROC / ROI	5	26.32
ROE	5	26.32
Change in Sales	4	21.05
Market to Book Ratio	3	15.79
Stock Returns	2	10.53
Cost of Debt	2	10.53
Cost of Equity	2	10.53
Dividend Yield	2	10.53
Net Profit	2	10.53
Cash holdings	1	5.26
Cash Flow to Total Capital	1	5.26
Debt to Total Capital	1	5.26
Return on Sales	1	5.26

Source: The authors.

Table 11 comprises different measures of the firm's performance. It indicates Tobin's Q is the most preferred measure of firm performance (used in around 52.63% papers). Thus, indicating firm value as preferred parameter of performance.

DISCUSSION AND CONCLUSION

Although the concept of sustainability is still in its nascent stages, it has gained significance over the last decade. An

organisation must adopt sustainability and duly consider the interests of all stakeholders to be successful (Burhan & Rahmanti, 2012). It must make the necessary disclosures, be transparent and honest about its actions to improve its reputation, revenue and to bring about a positive societal change (Mittal et al., 2019). Therefore, it suggests an association between sustainability or related disclosures and organisation's performance. Many authors attempted to examine this relationship and posit the existence of positive relationship between these variables.

To the best of our knowledge, there is a lack of comprehensive review of associated literature. Therefore, it was deemed necessary to analyse the existing research to explore historical and contemporary patterns. To obtain an accurate depiction, bibliometric analysis and content analysis of relevant studies have been conducted, where former suggests a rise in the number of studies especially in the last eight years. Additionally, an attempt has been made to analyse the quantity and quality of published documents from various authors, journals, and countries. The results pinpoint conduction of more research in developed nations than in developing nations, with the United States conducting maximum studies. Co-word analysis suggests that corporate governance, CSR, and financial performance are frequently used terms in title, abstracts, and keywords of the assessed literature. Moreover, detailed content analysis clarifies 'environment' and 'market performance' are the most preferred parameters of sustainability and performance, respectively. Furthermore, few studies are focussing on innovative sustainability practices like green R&D (Lee & Min, 2015), green information technology (Przychodzen et al., 2018) and green supply chain (Khan et al., 2016). Thus, indicating growth in interest of scholars and researchers in the underlying area.

SCOPE FOR FUTURE RESEARCH

This study expects to provide a comprehensive view to future researchers and foster deeper understanding about key emerging areas in the business and financial sector now-a-days. The study pinpoints gaps to provide a direction for future research.

Since, studies contradict on investors' preference of sustainable businesses (Dhasmana et al., 2023; Bocken, 2015), it is suggested to conduct studies to analyse and justify their attitude towards such businesses. Since, majority of studies focused exclusively on environment dimension (Maheshwari et al., 2023; Gupta & Gupta, 2020), CSR (Wang & Sarkis, 2017) or ESG (Brooks & Oikonomou, 2018) as acceptable parameters of sustainability. Since, KPMG (2020) discussed sustainability regarding an inter-relationship among environment, social, governance, and sustainable finance,

it is recommended to future researchers to use broader definitions of sustainability. Furthermore, only quantitative aspects of firm performance (accounting performance and market performance), where ROA (accounting performance) and Tobin's Q (market performance) are most preferred. Therefore, future researchers are suggested to utilise under-explored criteria of performance such as its non-financial components.

Moreover, risk (default risk and stock price crash risk) have been identified as the frequently occurring keywords, thereby, suggesting future researchers to further explore the relationship between sustainability and different types of risk along-with firm performance. Since, only a few studies attempted to investigate budding areas of sustainable practices. These can further be utilised as a main variable in studies and an attempt can be made to analyse whether such practices render any competitive advantage to the business. Thus, expand study by Mondal & Sahu (2023) on the impact of these green initiatives on firm performance.

Furthermore, limited use of variables like firm age (Abdi et al., 2022), gender diversity (Brinette et al., 2023), board composition (Al Homaidi et al., 2021), audit quality (Dakhli, 2022), and political connections (Almarayeh et al., 2022; Bose et al., 2021) have been observed in the sorted data. Future research may use these variables or identify more variables that may mediate or moderate the relationship between sustainability and performance.

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DAY-OF-THE-WEEK EFFECT DURING COVID-19 PANDEMIC: AN EMPIRICAL STUDY OF INDIAN STOCK MARKET

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Abstract *In the context of an efficient market, it is conventionally anticipated that uniform returns would manifest across weekdays. This study empirically scrutinised the manifestation of the day-of-the-week (DOW) effect within the Indian stock market amid the COVID-19 pandemic. Utilising daily closing price data spanning the COVID-19 period from March 11, 2020, to September 30, 2021, for three key indices (BSE Sensex, Nifty-50, and SX 40) listed on the Bombay Stock Exchange (BSE), National Stock Exchange (NSE), and Metropolitan Stock Exchange of India (MSEI), respectively, dummy variable regression analysis was employed to probe the DOW effect. The findings indicate that Monday returns exhibit negativity, a significant trend observed solely for the BSE Sensex index. Conversely, significant positive returns are evident on Tuesday, Wednesday (excluding SX40 index), and Friday, throughout the remaining weekdays. Moreover, Tuesday records the highest returns, closely followed by Friday. Thus, collectively, it can be inferred that both the Tuesday effect and the Friday effect are discernible within the Indian stock market amidst the COVID-19 pandemic period.*

Keywords: *Efficient Market Hypothesis (EMH), Day-of-the-Week-Effect, COVID-19 Pandemic, Dummy Variable Regression*

INTRODUCTION

In the realm of efficient markets, it is anticipated that consistent returns would be observed across weekdays. Eugene Fama, a proponent of the Efficient Market Hypothesis (EMH), articulated in 1965 that “the expected return on a financial asset should be uniformly distributed across different units of time.” However, despite this theoretical expectation, researchers have uncovered various calendar and seasonal anomalies within the stock market, including the January effect, turn-of-the-month effect, turn-of-the-year effect, and weekend effect. Among these anomalies, one of the most extensively studied phenomena is the “day-of-the-week effect” which suggests that returns on certain weekdays deviate abnormally from others. Cross (1973) was among the first to identify discrepancies in returns across weekdays, subsequently leading to the day-of-the-week (DOW) anomaly becoming a prominent and extensively documented feature in financial literature. Numerous studies have scrutinised and investigated the DOW effect in the Indian stock market, including works by Poskakwala (1996), Choudhury (2000), Goswami and Anshuman (2000), Ammanulla and Thiripalraju (2001), Bhattacharya et al.

(2003), Kaur (2004), Patel and Patel (2011), and Archana et al. (2014), among others.

Numerous empirical inquiries have been undertaken to scrutinise significant systemic occurrences within the stock market. For instance, studies have delved into the repercussions of pandemic outbreaks, such as the investigation conducted by Chen et al. (2018) concerning the SARS outbreak. Similarly, precedent and political events like pre-election and post-election have been subject to examination, as evidenced by the work of Rizvi et al. (2022), Bash and Alsaifi (2019), while natural disasters have been explored, as exemplified by the research conducted by Wang and Kutan (2013), Mishra et al. (2021). The emergence and global spread of the COVID-19 pandemic, originating in China, have not only profoundly impacted human life but have also disrupted stock markets across the global economy. Numerous investigations, including those by Al-Awadhi et al. (2020), Ahmar and Val (2020), Karim and Shetu (2023) among others, have underscored the adverse effects of COVID-19 on stock markets. Against this backdrop, the present study endeavours to explore the DOW effect within the Indian stock market amidst the COVID-19 pandemic.

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The remainder of this paper is structured as follows: Section 2 discusses the literature review, while Section 3 describes the objective and research methodology. Section 4 presents the analysis and interpretation of the results. Section 5 is the conclusion.

REVIEW OF LITERATURE

Dharani and Natarajan (2011) conducted a study on seasonal anomalies within the National Stock Exchange (NSE) spanning from 2007 to 2010, employing the t-test methodology. Their analysis did not reveal any significant differences in returns across various days. Sharma (2011) investigated the presence of the DOW effect within the Indian stock market between 2008 and 2009, utilising the Sensex and Nifty indices. This examination employed ANOVA and regression models, which indicated the absence of a DOW effect. Mehla and Goyal (2011) undertook a comparative analysis of the DOW effect anomaly during the pre-rolling and post-rolling settlement periods concerning the stock returns of the Nifty index. Employing GARCH (1,1) methodology with dummy variables, their findings revealed the presence of an anomaly specifically within the pre-rolling period.

Handa (2012) conducted an inquiry into the trading patterns of Foreign Institutional Investors (FIIs) throughout the weekdays within the period spanning from 2008 to 2010. Descriptive statistics alongside the ANOVA technique were employed for analysis, revealing the highest levels of both purchase and sale activities occurring on Thursday, while the lowest levels were observed on Monday. Overall, the study demonstrated the presence of a weekday effect. Kutchu (2012) scrutinised the weekday effect both before and after the implementation of the rolling settlement system, utilising the GARCH model across three indices of the NSE. The findings affirmed the existence of a Wednesday effect prior to the introduction of the rolling settlement system, which subsequently dissipated post-implementation, while a Friday effect became evident following the adoption of the rolling settlement system.

Sen (2013) conducted an analysis on the DOW effect within the Indian stock market, focussing on Nifty returns spanning from 1997 to 2012. Utilising the GARCH-M model, the study identified the presence of the DOW effect during the pre-T+2 rolling settlement period. However, following the introduction of T+2 settlement, this effect dissipated. Srinivasan and Kalaivani (2013) employed various models including GARCH (1,1), TGARCH (1,1), and EGARCH (1,1), over the period from 1997 to 2012 to investigate the week-day effect in both the NSE and BSE. Their findings indicated the presence of a week-day effect in both markets. Kumar and Mishra (2013) empirically examined the DOW

effect within the Indian economy using Ordinary Least Squares (OLS) regression over the period from 2007 to 2012. Their results, however, revealed the absence of a weekday effect.

Sudarvel et al. (2015) conducted a study to ascertain the presence of the DOW effect within the Indian Information Technology (IT) sector spanning from 2005 to 2015. Utilising OLS regression analysis, their findings corroborated the existence of this effect. Aziz and Ansari (2015) examined the DOW effect from 1990 to 2013 within the Indian stock market. Employing the GARCH model, their investigation revealed a positive Wednesday effect within the Nifty index and a positive Monday effect within the Sensex.

Gnanasekar and Rajesh (2016) investigated the DOW effect, focussing on the CNX Nifty index from 2005 to 2015. Employing the GARCH (1,1) model alongside regression analysis, their findings highlighted a noteworthy trend of higher returns observed on Mondays compared to other days, thereby indicating a robust Monday effect. Mitra (2016) revealed an absence of any discernible DOW effect during the specified period, utilising the GARCH model for analysis.

Kothari et al. (2017) conducted a comprehensive analysis of the DOW effect within the NSE and BSE indices, focussing on returns and volatility patterns spanning from 2005 to 2014. The study employed a multifaceted approach, integrating ANOVA, t-tests, and the GARCH (1,1) model for examination. The findings revealed significant returns within the Nifty Junior index, while no notable distinctions were identified between the NSE and BSE through ANOVA analysis. Moreover, the results from the GARCH model underscored the presence of a week-day effect, particularly evident on Monday, Tuesday, Wednesday, and Friday. Bhuva and Thankachan (2017) delved into the examination of the DOW effect within the automobile industry on the NSE from 2009 to 2013. Employing regression analysis and t-tests, their investigation unveiled the highest returns occurring on Thursday, contrasting with the lowest returns observed on Monday within the auto sector.

Arora (2018) investigated the DOW effect concerning the volatility and returns of the Nifty-50 index, analysing data in 5-minute intervals across periods "before and after the introduction of the pre-opening session." Employing the GARCH (1, 1) model for analysis, the findings revealed significant returns on Mondays and Fridays before the introduction of the pre-opening session. However, following the implementation of the pre-opening session, no discernible DOW effect was observed.

Patjoshi and Nandini (2020) substantiated the presence of a noteworthy disparity in returns across weekdays within the BSE, employing the GARCH (1,1) model over the period

from 2000 to 2018. Anwar et al. (2021) investigated the DOW effect across thirty developing countries during the period from 2011 to 2019, employing a panel GARCH model. Their analysis unveiled Tuesday as exhibiting the highest returns during the week, thus confirming the existence of a DOW effect. Dutta and Das (2021) unveiled significant Monday and Friday effects within the Nifty Fifty index in India over the period from 2001 to 2015. Advelli and Yelamanchili (2022) examined the DOW effect in the Indian market using the daily turnover of buying and selling of stocks by individual investors and found significant negative average returns on Monday during the study period of 16 years. Thomas (2022) investigated calendar anomalies such as the month of the year effect, turn of the month effect, and DOW effect using NSE and BSE data over the period from 1993 to 2013. The ANOVA technique was applied and results indicated the absence of DOW and month of year effect and the insignificant turn of the month effect.

Kumar and Singh (2023) checked the DOW anomaly in India over the period of 20 years, i.e. from 2000 to 2019, by categorising in three sub period- during 2008-09 crisis, before and after the crisis period. BSE Sensex return data was used and results pointed towards nonexistence of DOW effect as whole and also for sectorial indices. Aggarwal and Jha (2023) using NSE data examined DOW effect by adopting GARCH models and found positive and significant returns on all week days, hence evidences of the presence of DOW effect. Khan et al. (2023) compared DOW in the Asian market using GARCH, OLS, and Kruskal-Wallis test and depicted as in most of the market Monday is the least traded day. The study found significant DOW effect in Pakistan, China, Thailand, Taiwan, and South Korea whereas insignificant DOW effect showed by Malaysia and India. Overall, the study did not found evidence of co-occurrence of the DOW effect in returns data and volume data, hence affirms inconsistency.

Numerous empirical investigations have explored the phenomenon of the DOW effect within the Indian stock market, employing diverse methodological approaches such as regression models, GARCH models, t-tests, and ANOVA techniques. While some studies have revealed the presence of weekday effects, others have indicated their absence. Notably, in the latter half of the twentieth century, Monday consistently yielded significantly lower returns compared to other weekdays. Against the backdrop of the ongoing COVID-19 pandemic, global stock markets, including those in India, have experienced considerable adverse effects. Considering these circumstances, this study endeavours to scrutinise the week-day effect within the Indian stock market during the COVID-19 period.

RESEARCH METHODOLOGY

Research Objective

Given the backdrop of the ongoing COVID-19 pandemic, it becomes imperative to investigate the potential existence of the DOW effect within the Indian stock market. The current study aims to address this inquiry.

Data Collection

The dataset utilised for this study comprises the daily closing prices of three key market indices: the BSE Sensex from the Bombay Stock Exchange (BSE), the Nifty-50 from the National Stock Exchange (NSE), and the SX40 from the Metropolitan Stock Exchange (MSEI). These three stock exchanges are considered representative of the Indian stock market. Notably, they are among the nine active stock exchanges recognised by the Securities and Exchange Board of India (SEBI), as of January 17, 2020 (source: www.sebi.gov.in). While the NSE and BSE account for the majority of turnover in the market, the MSEI is unique in that it facilitates the trading of individual stocks alongside these two exchanges. Hence, these three stock exchanges are taken as sample. The time period spanning from March 11, 2020 (on which WHO declared COVID-19 as a pandemic), to September 30, 2021 was taken as a study period with 1164 as sample observation. The daily closing price data for all three indices were collected using secondary sources, i.e. from their respective official websites: www.bseindia.com, www.nseindia.com, and www.msei.in.

To explore the DOW effect, the daily closing price series of three indices were transformed into return series, computed as follows:

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right)$$

where,

- R_t = index return on current day t,
- \ln = natural logarithm,
- P_t = index closing price on current day t,
- P_{t-1} = index closing price on previous day t-1.

Research Methodology

In order to investigate the DOW effect, “Dummy Variable Regression” model is employed and is defined as:

$$R_t = \alpha + \gamma_1 D_1 + \gamma_2 D_2 + \gamma_3 D_3 + \gamma_4 D_4 + \mu$$

where,

- R_t = index return at time t,
- D_1 = dummy variable for Tuesday,
- D_2 = dummy variable for Wednesday,
- D_3 = dummy variable for Thursday,
- D_4 = dummy variable for Friday,
- μ = the error term or residual.

A dummy variable for Monday is omitted to prevent multicollinearity, a common issue known as the dummy variable trap, from arising in the model.

In the aforementioned equation, the coefficient α represents the mean return on Monday, which is also regarded as the benchmark day. Meanwhile, the coefficients $\gamma_1, \gamma_2, \gamma_3,$ and γ_4 signify the deviation in mean returns of the other days from this benchmark. A significant α suggests the presence of a weekend effect, whereas significance in any of the coefficients $\gamma_1, \gamma_2, \gamma_3$ or γ_4 indicates the existence of a DOW effect.

Analysis and Interpretation

Table 1 presents the descriptive statistics of the returns for all three indices: BSE Sensex, Nifty-50, and SX40, accompanied by the outcomes of the Jarque-Bera test for normality.

Table 1: Descriptive Statistics and Jarque-Bera Normality Test Results of Index Return

Particulars	BSE Sensex	Nifty-50	SX40
Mean	0.131	0.135	0.132
Minimum	-14.101	-13.904	-13.764
Maximum	8.595	8.400	8.50
Standard Deviation	1.720	1.682	1.678
Skewness	-1.806	-1.908	-1.853
Kurtosis	16.749	17.217	17.075
Jarque-Bera test (p-value)	4803* < 2.2e ⁻¹⁶	5087.8* < 2.2e ⁻¹⁶	4995* < 2.2e ⁻¹⁶

Source: Authors' computation, * significant at 5%.

Table 1 illustrates that during the COVID-19 pandemic period, the Nifty-50 index exhibited the highest mean return (0.135), followed by the SX40 and BSE Sensex indices, with values of 0.132 and 0.131, respectively. The BSE Sensex had the highest standard deviation (1.720) compared

to the Nifty-50 (1.682) and SX40 (1.672). Additionally, the skewness results indicate negative skewness for the returns of all three indices, while the kurtosis values suggest leptokurtic distributions, indicating non-normality in the return data. This observation is further supported by the statistically significant results of the Jarque-Bera test for all indices, indicating non-normality in the data distribution.

Nevertheless, for time series data, the concern lies more with stationarity rather than normality. To proceed with the analysis, it is imperative to ensure the stationarity of the data, which is examined using the Augmented Dickey-Fuller (ADF) test and Phillips-Perron (P-P) unit root test. The findings from these tests are presented in Table 2.

Table 2: Results of ADF and PP Unit Root Test for Indices Return

Particulars	BSE Sensex	Nifty-50	SX40
ADF test value (p-value)	-7.7423* (0.01)	-7.7132* (0.01)	-7.7447* (0.01)
P-P test value (p-value)	-443.87* (0.01)	-454.43* (0.01)	-453.23* (0.01)

Source: Authors' computation, * significant at 5%.

The results presented in Table 2 indicate that the Augmented Dickey-Fuller (ADF) and Phillips-Perron (P-P) unit root test statistics are statistically significant for all three indices. This suggests that the return data series exhibits stationarity throughout the study period.

Given the stationarity of the return series, the analysis proceeds with a dummy variable regression to investigate the DOW effect during the COVID-19 pandemic period. The results of the dummy variable regression, along with the outcomes of the Durbin-Watson (D-W) test for autocorrelation and the Breusch-Pagan (B-P) test for homoscedasticity of the residuals from the dummy variable regression model, are presented in Tables 3, 4, and 5 for the BSE Sensex, Nifty-50, and SX40 indices, respectively.

Table 3: Results of Dummy Variable Regression Model for BSE Sensex

Particulars	BSE Sensex	Nifty-50	SX40
α	-0.3904	-1.997	0.046*
γ_1 (Tuesday)	0.9440	3.447	0.001*
γ_2 (Wednesday)	0.5466	1.996	0.047*
γ_3 (Thursday)	0.4982	1.813	0.071
γ_4 (Friday)	0.5955	2.147	0.032*

Particulars	BSE Sensex	Nifty-50	SX40
R-squared:		0.03089	
Adjusted R-squared:		0.01821	
F-statistic:		2.435 (p-value: 0.03433*)	
Durbin-Watson test:		2.2216 (p-value: 0.987)	
Breusch-Pagan test:		6.3751 (p-value:0.2714)	

Source: Authors' computation, * significant at 5%.

The results presented in Table 3 indicate a significant negative value for the coefficient α , suggesting the presence of a weekend effect in the BSE. Additionally, the coefficients γ_1 , γ_2 , γ_3 , and γ_4 demonstrate positive values during the weekdays, with statistical significance observed for all days except Thursday (Tuesday, Wednesday, and Friday), indicating the presence of a DOW effect. The overall fit of the model is supported by the significant f-statistics value (p-value = 0.03433), indicating its adequacy. Moreover, the results of the Durbin-Watson (D-W) test and the Breusch-Pagan (B-P) test confirm the absence of autocorrelation and heteroscedasticity issues in the model residuals, as both test values are statistically insignificant. Therefore, based on these findings, it can be concluded that both weekend and DOW effects exist in the BSE.

Table 4: Results of Dummy Variable Regression Model for Nifty-50

Particulars	BSE Sensex	Nifty-50	SX40
α	-0.3702	-1.936	0.054
γ_1 (Tuesday)	0.9117	3.404	0.001*
γ_2 (Wednesday)	0.5292	1.976	0.049*
γ_3 (Thursday)	0.4719	1.756	0.080
γ_4 (Friday)	0.5916	2.180	0.030*
R-squared:		0.03038	
Adjusted R-squared:		0.01769	
F-statistic:		2.3940 (p-value: 0.03719*)	
Durbin-Watson test:		2.2356 (p-value: 0.991)	
Breusch-Pagan test:		6.2875 (p-value:0.2792)	

Source: Authors' computation, * significant at 5%.

The results presented in Table 4 reveal a negative value for the coefficient α , although it is found to be statistically insignificant, indicating the absence of a weekend effect in the NSE. Conversely, positive coefficients γ_1 , γ_2 , γ_3 and γ_4 are observed during weekdays, with statistical significance observed on Tuesday, Wednesday, and Friday. This confirms the presence of a DOW effect. The significance of the f-statistic (p-value = 0.03719) supports the adequacy of the regression model. Additionally, the results of the Durbin-Watson (D-W) test and the Breusch-Pagan (B-P) test indicate the absence of autocorrelation and heteroscedasticity in the

model residuals. Consequently, based on these findings, it can be concluded that while there is no weekend effect present in the NSE, there is indeed evidence of a DOW effect.

Table 5: Results of Dummy Variable Regression Model for SX40

Particulars	BSE Sensex	Nifty-50	SX40
α	-0.3683	-1.931	0.054
γ_1 (Tuesday)	0.8997	3.367	0.001*
γ_2 (Wednesday)	0.5218	1.953	0.051
γ_3 (Thursday)	0.4686	1.748	0.081
γ_4 (Friday)	0.5945	2.196	0.029*
R-squared:		0.02985	
Adjusted R-squared:		0.01715	
F-statistic:		2.351 (p-value: 0.04036*)	
Durbin-Watson test:		2.2391 (p-value: 0.9918)	
Breusch-Pagan test:		6.1061 (p-value:0.296)	

Source: Authors' computation, * significant at 5%.

The findings presented in Table 5 reveal a negative value for the coefficient α , which is deemed statistically insignificant. However, coefficients for Tuesday and Friday exhibit positive and statistically significant values, while those for Wednesday and Thursday are positive but lack statistical significance. This suggests the presence of a DOW effect specifically on Tuesday and Friday within the MSEI. The significant p-value (0.04036) associated with the f-statistic supports the adequacy of the regression model. Furthermore, the results of the Durbin-Watson (D-W) test and the Breusch-Pagan (B-P) test confirm the absence of autocorrelation and heteroscedasticity in the model residuals. Consequently, based on these findings, it can be inferred that while there is no weekend effect present in the MSEI, there is indeed evidence of a DOW effect specifically on Tuesday and Friday within this market.

CONCLUSION

In line with the efficient market hypothesis, which posits that the anticipated returns on financial assets should be uniformly distributed across various temporal intervals, the findings derived from the analysis employing dummy variable regression suggest distinctive patterns in the returns within the Indian stock market during the COVID-19 pandemic period. Specifically, negative returns are discerned solely on Mondays and are statistically significant solely for the BSE Sensex index. Conversely, the remaining weekdays—Tuesday, Wednesday (excluding the SX40 index), Thursday, and Friday—exhibit statistically significant positive returns,

with Tuesday and Friday demonstrating the highest returns. Consequently, it can be inferred that the Indian stock market manifests discernible Tuesday and Friday effects on returns during the COVID-19 pandemic era. While these effects present opportunities for investors to potentially enhance returns by strategically navigating this anomaly, they also raise questions regarding market efficiency. The results of the study are also useful for academicians to check EMH as it points towards a low level of efficiency.

The present study is limited to only the stock market, it may be further applied to other markets such as crypto currency markets, derivative markets, etc. Also, the researchers may examine the DOW effect before and after the COVID-19 pandemic period. It will be more beneficial if the investigated along with DOW effect, as it will provide a broader picture regarding market efficiency in the Indian market.

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DETERMINANTS OF RISK MANAGEMENT DISCLOSURES OF LIFE INSURANCE COMPANIES IN INDIA: AN EMPIRICAL STUDY

Jigyasa Sharma*, Arvind Kumar**

Abstract *The insurance sector, with a focus on life insurance companies, has become an essential component of India's financial landscape. It not only safeguards individuals and families from financial risks but also contributes to the country's economic development by channelling funds into long-term investments. In the pursuit of this mission, they are tasked with managing a diverse spectrum of risks, including market risk, credit risk, morbidity risk, operational risk, persistency risk, and catastrophe risk. Risk management disclosures in life insurance companies are essential for providing stakeholders with a clear understanding of the risks the company faces and how it manages those risks. Keeping in view the certain limitations, the data of major private and public sector players (as a sample) in the field of life insurance has been taken into consideration for the period of 10 years commencing from 2013-14 to 2022-23, and to justify the study, the various statistical methods like coding, ranking, ratio analysis, and pooled regression analysis have been used. The study is an attempt to analyse the impact of risk disclosure on the financial performance of life insurance companies in India because in a sector where trust and financial stability are paramount, prioritising high-quality risk disclosures is crucial for the long-term success and resilience of life insurance companies in India. The findings of this study highlight that the effective risk management is crucial to uphold the life insurers' financial stability, meet policyholders' claims, and maintain solvency.*

Keywords: *Life Insurance Companies, Financial Performance, Risk Management and Risk Disclosure*

INTRODUCTION

The insurance sector in India has witnessed remarkable growth and transformation in recent decades, making it one of the most dynamic and significant parts of the country's financial services industry. The insurance sector, with a focus on life insurance companies, has become an essential component of India's financial landscape. It not only safeguards individuals and families from financial risks but also contributes to the country's economic development by channelling funds into long-term investments. Life insurance companies in India are committed to securing the financial futures of their policyholders while managing a wide array of risks, such as market risk, credit risk, morbidity risk, operational risk, persistency risk and catastrophe risk, they must effectively manage these risks to ensure their solvency and the fulfilment of policyholders' claims. The study is an attempt to analyse the impact of risk disclosure on the financial performance of life insurance companies in

India because in a sector where trust and financial stability are paramount, prioritising high-quality risk disclosures is crucial for the long-term success and resilience of life insurance companies in India.

LIFE INSURANCE COMPANIES IN INDIA

Life insurance in India has witnessed a remarkable transformation over the years, evolving from a limited sector to a thriving industry with a broad and diverse range of offerings. Life insurance in India has a rich history dating back to the early 19th century when the first life insurance company was established. The sector saw nationalisation in the mid-20th century, leading to the formation of the Life Insurance Corporation of India (LIC), which became the largest and most prominent insurer in the country. India's life insurance market is one of the fastest-growing in the world. It features a mix of public and private insurers,

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with LIC maintaining a dominant market share. However, private sector players have gained significant traction and market share, offering a wide array of innovative and customer-centric products. The Insurance Regulatory and Development Authority of India (IRDAI) is the regulatory body overseeing the insurance industry in the country. It sets guidelines and regulations for the operation and conduct of life insurance companies to protect the interests of policyholders. Life insurance is a financial contract that provides protection and financial security to policyholders and their beneficiaries in the event of the policyholder's death. A life insurance company is a financial institution that specialises in offering various life insurance products to individuals and groups. These companies collect premiums from policyholders and, in return, provide death benefits, savings, and investment options. In India, as per the Insurance Regulatory and Development Authority of India (IRDAI), there are currently 24 life insurance companies operating in the market. Over the years, there has been a significant increase in awareness about the importance of life insurance in India. This heightened awareness is driven by rising income levels, urbanisation, and an increased focus on financial planning and security.

EFFECTIVE RISK MANAGEMENT IN LIFE INSURANCE COMPANIES - SAFEGUARDING THE FUTURE

Life insurance companies in India face various types of risks, which can significantly impact their financial stability and long-term viability. The major types of risks faced by these companies include:

- *Market Risk:* Market risk includes interest rate risk, equity risk, and currency risk. Fluctuations in financial markets can impact the value of investments and liabilities on the insurer's balance sheet. Asset-liability management (ALM) is used to mitigate market risk by aligning assets with liabilities. This helps ensure that policyholders' payouts remain secure, even during volatile market conditions.
- *Operational Risk:* Operational risk encompasses a wide range of risks associated with internal processes, systems, and human errors. These risks can lead to financial losses, legal liabilities, and reputational damage. Effective operational risk management is essential to prevent such events.
- *Liquidity Risk:* Liquidity risk arises from the mismatch between cash inflows (premiums) and outflows (claims and policyholder defaulters). Life insurance companies manage this risk by maintaining adequate liquidity buffers, reinsurance arrangements, and

prudent investment strategies. This ensures they can meet policyholder obligations, even during periods of heightened claims.

- *Persistency Risk:* Persistency risk relates to the likelihood of lapses, surrenders, or non-renewals of insurance policies. High persistency rates are desirable, as they result in more stable cash flows and better long-term profitability. Low persistency rates can affect the insurer's financial performance.
- *Credit Risk:* Credit risk arises from investments in fixed-income securities, where issuers may default on their obligations. Life insurers must manage credit risk effectively to prevent losses from defaults in their investment portfolios.
- *Catastrophe Risk:* Catastrophe risk arises from natural disasters, pandemics, or other catastrophic events. Life insurance companies need to have the financial resources to fulfil their obligations to policyholders in the event of a catastrophe.

Thus, to provide transparency and instill confidence among stakeholders, including policyholders, investors, and regulators, life insurance companies in India are required to make comprehensive risk-related disclosures. Hence, effectively managing and mitigating these various risks is essential for the financial stability and continued success of life insurance companies in India.

LITERATURE REVIEW

Thirupathi and Subhashini (2022) aim to identify the key determinants influencing the financial performance of HDFC Life Insurance Company to uncover the factors that impact the profitability of the selected private life insurance company. The research intends that the liberalisation, privatisation, and globalisation in the insurance sector, driven by increased competition from new private insurers, have led to the introduction of innovative products and customer incentive schemes, and to maintain and attract customers, insurance companies need to be financially solvent and profitable, as profitability is a crucial indicator of their financial performance.

Shahi and Agnihotri (2022) in their research delved into the drivers of profitability for insurance companies operating in India through a multiple linear regression analysis. It examined parameters including liquidity, tangibility, and the scale of firms based on the number of agents in each state. The study's findings highlighted that a combination of liquidity, tangibility, and the scale of business in terms of the number of agents across states significantly influenced the profitability of life insurance companies in India. This suggests that diversifying the range of insurance offerings

and maintaining high liquidity is essential for insurance companies to enhance their profitability and reputation in the competitive market. The study recommended expanding the sample size in future research to enhance analysis accuracy and confidence in generalising findings. Additionally, it underscored the importance of including general insurance companies in similar analyses for more comprehensive insights.

Mohan and Sumathy (2021) had done a comprehensive analysis of the financial performance of public and private life insurance companies in India using various financial ratios. The study concludes that the financial performance of public and private life insurance companies in India is influenced by various factors such as profitability, solvency, and liquidity. The study suggests that the selected life insurance companies should focus on improving their financial performance by optimising their asset utilisation and managing their liabilities effectively.

Suvvari et al. (2019) evaluate the financial performance of 24 Indian life insurance companies from 2013 to 2016. Using GRA, the study ranks these companies based on 14 financial indicators, including capital adequacy, liquidity, operating, and profitability ratios. Shriram Insurance was found to have the highest relational grade, followed by IDBI Insurance, Sahara Insurance, and the Life Insurance Corporation of India. The research highlights the critical role of profitability ratios, including those with negative values, in assessing financial performance. The study suggests that the Indian life insurance industry should focus more on these ratios to improve financial health and underscores the effectiveness of GRA in providing a comprehensive and unbiased analysis compared to traditional methods.

Ramanchi and Satuluri (2019) opined that the life insurance industry in India has remained highly attractive to foreign insurance companies, with significant Foreign Direct Investments flowing into the sector due to the country's low insurance penetration and density. Despite 18 years of private sector involvement and substantial capital deployment, a number of insurance companies are still grappling with accumulated losses. The industry's profitability has proven elusive, with profitability closely correlated with the amount of capital deployed. While there has been notable progress, India lags behind countries like Taiwan, Hong Kong, and South Africa in insurance penetration and density. In recent years, regulators have shifted the industry's focus from top-line growth to bottom-line performance, leading to a cautious approach by insurance companies in terms of capital deployment for expansion. Scalability and increased capital deployment are now seen as essential to drive the industry's growth.

Adhikari and Ghosh (2018) provide a detailed comparative analysis of three private sector life insurance companies in India during the period from 2008-2009 to 2013-2014. The study concludes that private sector life insurance companies in India need to focus on maintaining a robust financial position through effective management of profitability, solvency, and liquidity. This strategic approach is essential for gaining a competitive advantage in the dynamic and competitive insurance market. The research highlights the significant impact of financial sector reforms and the intensified competition in the Indian life insurance market, emphasising the importance of maintaining a sound financial position for competitive advantage.

Hariharan et al. (2017) investigate the reporting practices of Indian life insurance companies concerning risk management and risk governance in their annual reports, evaluating factors such as disclosure quality related to risk management frameworks, risk governance practices, the independence and profile of chief risk officers, the explanation of risk policies, and quality certifications. Despite adhering to the same corporate governance guidelines established by the Insurance Regulatory and Development Authority of India (IRDAI), the study uncovers substantial disparities in the content of their disclosures.

Trivedi (2016) in her study, focusses on the increasing importance of risk analysis and risk management in the Indian insurance sector, particularly within the context of economic liberalisation. It highlights that managing risk is a fundamental challenge for insurance companies, given the inherent nature of the industry. The research is specifically concentrated on life insurance companies in the Indian state of Rajasthan, with a primary focus on their risk management strategies, policies, and internal controls, contributing to a more comprehensive understanding of risk management in the Indian life insurance industry.

Joo (2013) in the study analysed the financial performance of the selected insurance companies using three financial indicators from the CAMEL model: Earnings and Profitability, Management Soundness, and Liquidity. The analysis includes the use of ratio analysis and statistical tools such as mean, standard deviation, and F-test to test the CAMEL parameters statistically. The study concluded that the financial stability of Indian non-life insurance companies is influenced by factors such as claim ratio and firm size. The findings suggested that insurance companies should focus on improving their underwriting performance and managing their expenses effectively to maintain solvency.

Kaur Bawa and Chattha (2013) underscore the importance of identifying factors that can enhance the profitability

of insurance companies and benefit investors, ultimately contributing to the growth of the industry and the overall success of the economy. The study revealed that among the Indian life insurers, the public sector company LIC stands out with a strong liquidity position and consistently stable solvency. The study concluded that profitability demonstrates a notable positive correlation with liquidity and company size, while it exhibits a negative association with the capital held by the company.

Kumari (2013) analyses the Indian life insurance industry, both the public and private sectors, with a focus on various parameters such as the number of insurance companies, private sector offices, insurance penetration, density, premium income growth, and the size of the insurance market. The study revealed a substantial enhancement in the overall business performance of the Indian life insurance industry following privatisation. The research paper aims to comprehend the state of the life insurance sector in India and address issues related to competition within the industry. India's robust economic growth, driven by liberalisation policies since the early 1990s, has significantly improved living standards, and the financial sector's opening has played a pivotal role in this process.

International

Rashidi (2024) is of the opinion that risk is fundamental to the existence of the insurance industry. Through insurance contracts, customers transfer their financial uncertainties to insurers in exchange for premiums. Life insurance contracts offer protection against risks such as death, longevity, morbidity, critical illness, and healthcare costs. Other types of insurance provide coverage for property-related contingencies like fire, theft, accidents, and storms. Consequently, an insurer's core operations involve estimating the amount and timing of policyholder payments and determining their present value, considering the future costs of administering these obligations. These activities are inherently risky. It is crucial for insurers to manage the risks embedded in the insurance contracts they underwrite. This paper emphasises the significance of risk management processes for life insurance companies. It explores applied strategies for managing key risks effectively, ensuring that insurers can meet their obligations and maintain financial stability. By implementing robust risk management practices, life insurance companies can better handle the uncertainties associated with their core operations and enhance their overall performance.

Wang (2024) in his study, aims to explore the relationship between financial risk and financial performance within the Chinese life insurance sector over a decade, from 2011 to

2021. China Life Insurance Company is the largest state-owned financial and insurance enterprise in China that plays a pivotal role as an institutional investor in the Chinese capital market. The interconnection between financial risk and financial performance is a critical area of study, particularly for insurance companies that need to balance these aspects to enhance their performance potential. By analysing key financial ratios and employing quantitative methods alongside multiple regression models, this paper uncovers how financial risks influence the performance of Chinese life insurance companies.

Segodi and Sibindi (2022) unearthed that the life insurance industry has grown significantly over the years. This study aimed to identify factors influencing life insurance demand in BRICS countries (Brazil, Russia, India, China, and South Africa) from 1999 to 2020. While previous research primarily focused on demand-side determinants, this study also examined supply-side factors, including financial regulation. Using panel data econometric techniques, the research found that life insurance demand (measured by life insurance density and penetration) is negatively impacted by income, unemployment, interest rates, and inflation. Conversely, economic growth and financial freedom positively influence life insurance demand. The findings suggest that deregulation of the life insurance sector could enhance financial freedom and stimulate demand.

Mazviona, Dube, and Sakahuhwa (2017) examined the factors affecting the performance of insurance companies in Zimbabwe. The authors utilised secondary data from twenty short-term insurance companies for the period from 2010 to 2014. They employed factor analysis and multiple linear regression models to determine the factors affecting performance and identify their impact. The study found that expense ratio, claims ratio, and the size of a company significantly affect insurance companies' performance. The findings suggest that insurance companies in Zimbabwe should focus on reducing their expense ratios and claims ratios to improve their financial performance. Additionally, the study highlights the importance of company size in determining performance, indicating that larger companies tend to perform better. Overall, the study provides valuable insights into the key factors affecting the performance of insurance companies in Zimbabwe, which can inform regulatory and policy decisions aimed at enhancing the financial stability and competitiveness of the insurance sector.

Wani and Ahmad (2015) opined that the insurance companies, by their very nature, engage in risk-taking by writing policies that cover specific and often exotic risks globally. Traditional insurance coverage is evolving into comprehensive risk management, aimed at minimising costs

and ensuring prudent protection. Effective risk management is crucial for insurance companies to achieve robust financial performance. This study investigates the relationship between financial risk and financial performance in Indian life insurance companies, focussing on the period under consideration. Using a multiple linear regression model, the study identifies key determinants of financial performance: capital management risk, solvency risk, liquidity risk, volume of capital, and company size. This research underscores the importance of robust risk management practices in insurance companies and provides valuable insights for enhancing financial performance through strategic risk and asset management.

RESEARCH GAP

The life insurance industry stands as a pillar of financial security for countless individuals, groups, and families. Yet, the sector is riddled with inherent risks that necessitate meticulous risk management. In recent years, life insurance companies operating in India have encountered a shifting landscape characterised by dynamic market forces, regulatory modifications, and heightened competition. In light of these challenges, the critical importance of effective risk management becomes apparent. The extent to which proficient risk management impacts the financial performance of life insurance companies, however, remains a notable research gap which are yet not incorporated in the above literature review and requires exploration. Hence, understanding this relationship is paramount for maintaining investor confidence and ensuring the long-term financial stability of these institutions.

OBJECTIVES OF THE STUDY

The primary objective of the research is to explore and identify the diverse spectrum of risks that confront the life insurance companies operating in India. The study sets out to scrutinise the depth and quality of these risk management practices and their profound influence on the financial performance of these insurers. It also strives to gauge the extent to which these practices are integrated and the degree to which they align with industry best practices and regulatory standards. Thus, by elucidating the interplay between effective risk management strategies and financial outcomes, this research aims to provide valuable insights that can aid in enhancing the financial stability and overall performance of the Indian life insurance industry.

RESEARCH METHODOLOGY

Problem Statement

Determinants of Risk Management Disclosures of Life Insurance Companies in India: An Empirical Study.

RESEARCH DESIGN

This study is underpinned by a research design that combines both descriptive and empirical methodologies, offering a comprehensive approach to investigating the research problem in hand. The descriptive research is focused on describing and summarising a subject without manipulation or hypothesis testing, while empirical research involves testing hypotheses and drawing conclusions based on data collected through direct observation or experimentation. Descriptive research can be a component of empirical research when it involves collecting and describing data for empirical analysis and hypothesis testing.

DATA COLLECTION METHOD

This study predominantly leans on secondary sources of information, encompassing, management reports, annual reports of the selected companies, reports from the Insurance Regulatory and Development Authority of India (IRDAI), published scholarly journals, and pertinent website content, among others.

Sample Profile

The study encompasses a sample of 16 life insurance companies, chosen through a combination of random sampling techniques and judicious selection with careful consideration given to data availability constraints for certain entities in the field of life insurance for 10 years commencing from the financial year 2013-14 to 2022-23.

Statistical Tools and Techniques

The analysis of the collected data has been facilitated through the utilisation of MS-Excel and R software as the analytical tool and a pooled regression analysis technique has been used.

Variables of the Study

The variables of the study include solvency ratio, net NPA ratio, loss ratio, opex ratio, current ratio, persistency ratio, and combined ratio.

Research Equation

The regression equation can be expressed as:

$$\text{Persistency Ratio} = \beta_0 + \beta_1 \text{ Net NPA Ratio} + \beta_2 \text{ Combined Ratio} + \beta_3 \text{ Loss Ratio} + \beta_4 \text{ Current Ratio} + \beta_5 \text{ Solvency Ratio} + u_i + \varepsilon_{it}$$

where,

Persistency Ratio is the dependent variable.

Net NPA Ratio, Combined Ratio, Loss Ratio, Current Ratio, and Solvency Ratio are the independent variables.

β_0 = Intercept (constant term)

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ are the coefficients of the respective independent variables.

u_i = represents the random effects specific to each insurance company;

ε_{it} = is the idiosyncratic error term for each observation i at time t .

Hypothesis of the Study

Hypothesis for the present study is:

- H_{01} : There is no significant relationship between the financial performance and risk management disclosures.

Risk Ratios

Sr. No.	Risk	Ratio	Formula	Target
1.	Market risk	Solvency ratio	Total Assets/ Total Liabilities	Ideal Solvency ratio = 1.50 as per IRDAI Higher the better
2.	Credit Risk	Net NPA ratio	Net NPA/ Net Advances	Lower the better
3.	Morbidity Risk	Loss Ratio	Incurred Claims / Earned Premiums	Lower the better
4.	Liquidity Risk	Current Ratio	Current Asset / Current Liabilities	Ideal ratio 1.33:1
5.	Persistency Risk	Persistency Ratio	Number of Policies in Force at the End of the Period)/ Number of Policies in Force at the Beginning of the Period	Higher the better

Limitations of the Study

Similar to any research endeavour, this study encounters specific constraints, which include:

- This research study functions within a defined timeframe and confines its examination to specific criteria.
- The research depends on secondary data, which comes with inherent limitations.
- All computations are based on the data available as of the respective balance sheet date.
- The day-to-day fluctuations have been excluded from the dataset due to the practical constraints related to the unavailability of granular information for the researcher.
- The study's scope is limited to a subset of life insurance companies, potentially impacting the generalisability of findings to other life insurers within the industry.

DATA ANALYSIS AND INTERPRETATION

Life insurance companies operating in India are dedicated to safeguarding the financial well-being of their policyholders. In the pursuit of this mission, they are tasked with managing a diverse spectrum of risks, including market risk, credit risk, morbidity risk, operational risk, persistency risk, and catastrophe risk. Effective risk management is crucial to uphold their financial stability, meet policyholders' claims, and maintain solvency. Risk management disclosures in life insurance companies are essential for providing stakeholders with a clear understanding of the risks the company faces and how it manages those risks. The ratios associated with the mentioned risks are often used in the insurance and financial industries to assess and manage various types of risks. The chart below presents these risks alongside the corresponding ratios and their respective formulas:

Sr. No.	Risk	Ratio	Formula	Target
6.	Operational Risk	Opex Ratio	Operating Expense /Gross Written Premium	Lower the better
7.	Catastrophe Risk	Combined Ratio	(Operating expenses + Commission + Provision for Doubtful debts + Bad debts written off)/Gross written premium)	Lower the better

Source: Compiled by author.

The comprehensive examination of these crucial variables concerning selected life insurance companies for the years 2014-2023 have been conducted using necessary tables and charts.

Table 1: Market Risk – Solvency Ratio

Company	Solvency Ratio ¹			
	2022	2023	10 Years' Average ²	Rank ²
Aditya Birla SunLife Insurance Company Limited	188%	173%	193%	13
Ageas Federal Life Insurance Company Limited	312%	324%	372%	2
Bajaj Allianz Life Insurance Company Limited	581%	516%	677%	1
Bharti AXA Life Insurance Company Limited	162%	163%	179%	15
Canara HSBC Life Insurance Company Limited	282%	252%	349%	3
Edelweiss Tokio Life Insurance Company Limited	211%	220%	229%	10
HDFC Life Insurance Company Limited	176%	203%	192%	14
ICICI Prudential Life Insurance Company Limited	205%	209%	260%	9
Kotak Mahindra Life Insurance Company Limited	273%	283%	297%	4
Life Insurance Corporation India	185%	187%	164%	16
Max life Insurance Company Limited	201%	190%	288%	5
PNB MetLife India Insurance Company Limited	209%	186%	204%	12
Reliance Nippon Life Insurance Company Limited	235%	229%	279%	7
SBI Life Insurance Company Limited	205%	215%	210%	11
Shriram Life Insurance Company Limited	205%	210%	266%	8
TATA AIA Life Insurance Company Limited	196%	186%	287%	6

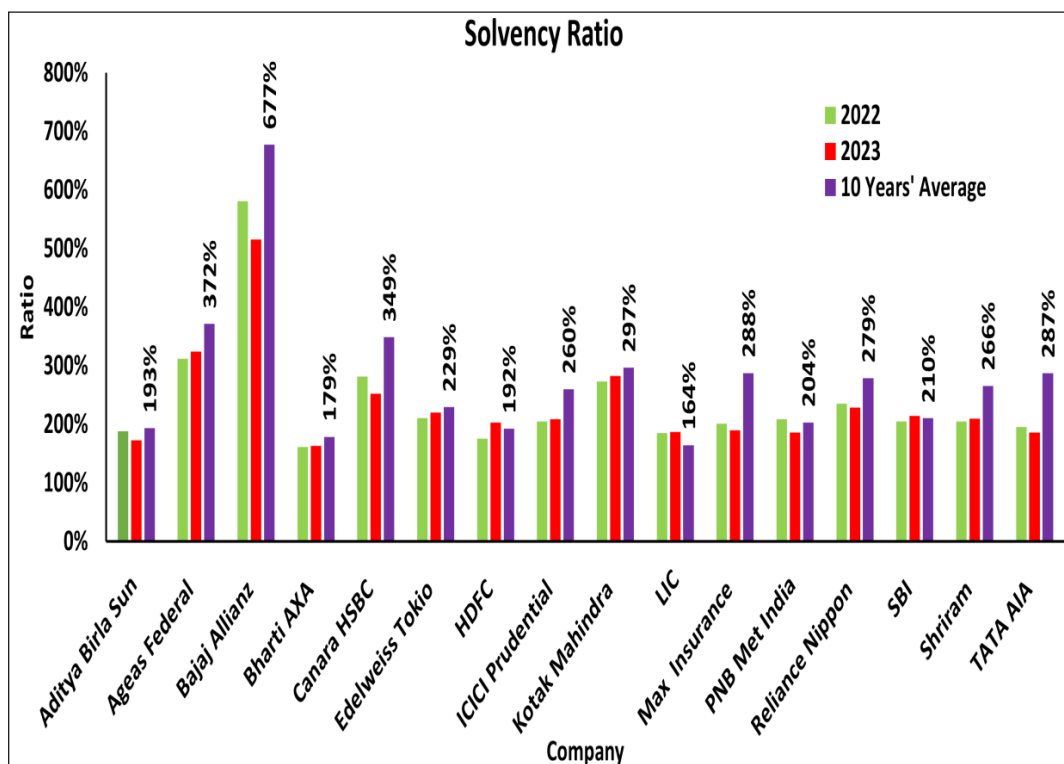
Source: ¹Compiled from annual report. ²Author's Computation.

Table 1 provides the comparative analysis of solvency ratios and ranks of various insurance companies in the context of market risk for the years 2022 and 2023, along with their 10 years' average solvency ratios. The solvency ratios represent the companies' financial strength and ability to meet their obligations. It is important to note that the ranks are given in descending order, meaning that a higher rank indicates a higher solvency ratios and all companies in this analysis maintain solvency ratios of more than 150%, as prescribed by IRDAI. Among all the listed companies, Bajaj Allianz Life Insurance Company Limited holds the highest 10 years' average solvency ratio at 677%, followed by Ageas Federal Life Insurance Company Limited at 372%. Conversely, LIC has the lowest solvency ratio, standing at 164%. The ranks indicate the relative financial strength of the insurance companies from 2014 to 2023. It's worth noting that most

companies maintained or improved their solvency ratios within this context. Bajaj Allianz Life Insurance Company Limited and Ageas Federal Life Insurance Company Limited claim the top two ranks, signifying their strong financial positions. In contrast, Bharti AXA Life Insurance Company Limited and LIC are ranked 15th and 16th respectively, which suggests a lower solvency ratio compared to others. Kotak Mahindra Life Insurance improved its solvency ratio from 2022 to 2023 and maintained a top position (4th rank), suggesting effective financial management and risk mitigation strategies. PNB Met Life India Insurance Company Limited experienced a significant decline in its solvency ratio and rank from 2022 to 2023 with a 10 years average at 204%, indicating potential financial instability that requires attention. Companies like Bajaj Allianz (Rank 1), Ageas Federal (Rank 2), and Canara HSBC Insurance

(Rank 3) consistently maintain strong financial positions and secure top ranks, indicating their financial stability. Conversely, HDFC Life (Rank 14), Bharti AXA Life Insurance (Rank 15), and LIC (Rank 16) appear to have the

most room for improvement, as they rank lower in solvency ratios. Chart 1 showcases the graphical representation of data tabulated in Table 1.



Source: Graphical representation of data using MS-Excel.

Chart 1: Solvency Ratio

The solvency ratio of the sample life insurance companies depicted by green, red, and purple colour, respectively. for the years 2022 and 2023 along with 10 years’ average is

Table 2 : Credit Risk – Net NPA Ratio

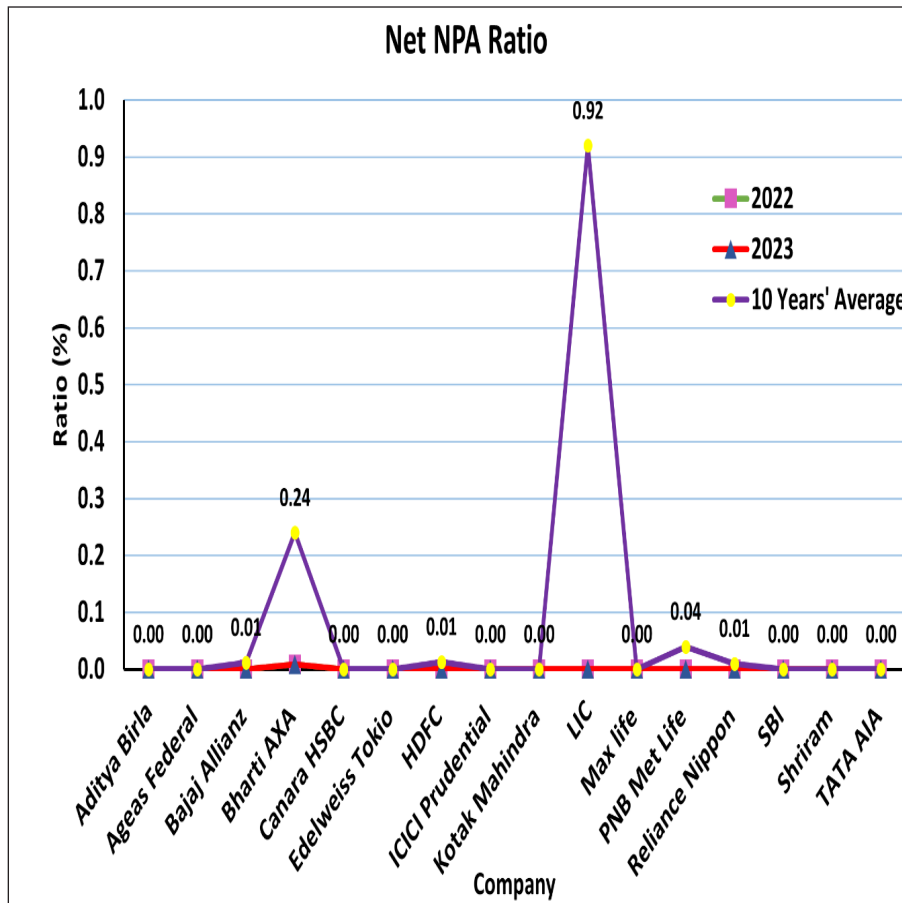
Company	Net NPA Ratio ¹			
	2022	2023	10 Years' Average ²	Rank ²
Aditya Birla SunLife Insurance Company Limited	0.0%	0.0%	0.00%	1
Ageas Federal Life Insurance Company Limited	0.0%	0.0%	0.00%	1
Bajaj Allianz Life Insurance Company Limited	0.0%	0.0%	0.01%	12
Bharti AXA Life Insurance Company Limited	0.9%	0.9%	0.24%	15
Canara HSBC Life Insurance Company Limited	0.0%	0.0%	0.00%	1
Edelweiss Tokio Life Insurance Company Limited	0.0%	0.0%	0.00%	1
HDFC Life Insurance	0.0%	0.0%	0.01%	13
ICICI Prudential Life Insurance	0.0%	0.0%	0.00%	1
Kotak Mahindra Life Insurance	0.0%	0.0%	0.00%	1
Life Insurance Corporation	0.0%	0.0%	0.92%	16
Max life Insurance	0.0%	0.0%	0.00%	1
PNB MetLife India Insurance Company Limited	0.0%	0.0%	0.04%	14

Company	Net NPA Ratio ¹			
	2022	2023	10 Years' Average ²	Rank ²
Reliance Nippon Life Insurance Company Limited	0.0%	0.0%	0.01%	11
SBI Life Insurance Company Limited	0.0%	0.0%	0.00%	1
Shriram Life Insurance Company Limited	0.0%	0.0%	0.00%	1
TATA AIA Life Insurance Company Limited	0.0%	0.0%	0.00%	1

Source: ¹Compiled from the annual report. ² Author's Computation.

The Net NPA (Non-Performing Assets) ratio is a critical metric for evaluating the credit risk of financial institutions, including insurance companies. It measures the proportion of bad loans or assets that are not generating income in relation to the total assets held by the company. A lower Net NPA ratio indicates a healthier credit risk profile, as it suggests that a smaller portion of the company's assets is at risk of default or non-payment. In the given data, the companies are ranked in ascending order of their Net NPA ratio, this means that companies with a lower Net NPA ratio are in high-ranking order, indicating a better credit risk profile, and vice-versa. The majority of the companies in the study, with only a few exceptions, maintain a Net NPA ratio of 0.00% over a period of 10 years. This signifies that they

demonstrate robust credit risk management practices and exhibit a high level of financial stability. These companies are effectively managing their credit risk and performing admirably in this aspect. The 10 years' average net NPA ratio of Life Insurance Corporation is 0.92%, reflecting unsatisfactory risk management practices and an inability to minimise loan defaults and non-performing investments. However, Reliance Nippon (0.01%), Bajaj Allianz (0.01%), HDFC Life (0.01%), PNB Life (0.04%), and Bharti AXA Life Insurance Company Limited (0.24%) have a higher Net NPA ratio compared to the companies with a 0.00% net NPA ratio during the decade, indicating marginal credit risk compared to the others. Chart 2 is the pictorial view of data arranged in Table 2.



Source: Graphical representation of data using MS-Excel.

Chart 2: Net NPA Ratio

The net NPA ratio of the selected life insurance companies for the years 2022 and 2023, along with 10 years’ average net NPA ratio is depicted by green, red, and purple colour, respectively.

Table 3: Morbidity Risk-Loss Ratio

Company	Loss Ratio ¹			
	2022	2023	10 Years’ Average ²	Rank ²
Aditya Birla SunLife Insurance Company Limited	58.0%	39.7%	69.6%	13
Ageas Federal Life Insurance Company Limited	51.1%	60.2%	41.5%	5
Bajaj Allianz Life Insurance Company Limited	56.7%	66.4%	88.8%	16
Bharti AXA Life Insurance Company Limited	30.1%	29.9%	37.3%	2
Canara HSBC Life Insurance Company Limited	45.4%	43.8%	58.6%	10
Edelweiss Tokio Life Insurance Company Limited	22.3%	26.3%	11.6%	1
HDFC Life Insurance	70.2%	68.5%	55.9%	9
ICICI Prudential Life Insurance	80.8%	80.4%	70.8%	14
Kotak Mahindra Life Insurance	45.5%	42.4%	46.1%	6
Life Insurance Corporation	82.7%	71.6%	66.7%	11
Max life Insurance	42.2%	40.1%	39.4%	3
PNB MetLife India Insurance Company Limited	43.1%	34.8%	51.3%	7
Reliance Nippon Life Insurance Company Limited	62.0%	48.1%	82.8%	15
SBI Life Insurance Company Limited	53.5%	45.2%	51.8%	8
Shriram Life Insurance Company Limited	37.1%	30.0%	40.7%	4
TATA AIA Life Insurance Company Limited	29.3%	24.0%	67.8%	12

Source: ¹Compiled from the annual report. ² Author’s Computation.

The loss ratio of life insurance companies is a critical metric, indicating the proportion of premiums paid out as claims or benefits to policyholders, which is used as an indicator of morbidity risk. A lower loss ratio generally suggests that a company is better at managing and pricing its policies, as it pays out a smaller portion of its premiums in claims. In Table 3, the companies are ranked in ascending order of their loss ratio, meaning that higher-ranked companies have lower loss ratios, signifying better financial performance, and conversely, lower-ranked companies have higher loss ratios, indicating poorer financial performance. Edelweiss Tokio Life Insurance Company Limited leads with the lowest 10-year average loss ratio of 11.6%, indicating efficient management of morbidity risk. On the contrary, Bajaj Allianz Life Insurance Company Limited has the

highest 10-year average loss ratio of 88.8%, placing it at 16th rank, indicating a larger percentage of policyholders filing claims, which may suggest a higher morbidity risk among their policyholders. Bharti AXA Life, Max Life Shriram Life Insurance, and Ageas Federal Life Insurance Company maintain a reasonably low loss ratio, indicating stable performance and good management of morbidity risk. SBI Life, Bajaj Allianz, Reliance Nipon and Aditya Birla Sunlife insurance companies have significantly improved their loss ratios from 2022. However, ICICI Prudential Life, HDFC Life, and LIC have consistently high loss ratios, suggesting a need to review their underwriting and risk assessment processes. For a better understanding, Chart 3 depicts the data compiled in Table 3.



Source: Graphical representation of data using MS-Excel.

Chart 3: Loss Ratio

The loss ratio of the life insurance companies under study for the years 2022 and 2023 is depicted by green-, red- and purple-coloured lines, respectively along with a data table for easy comprehension.

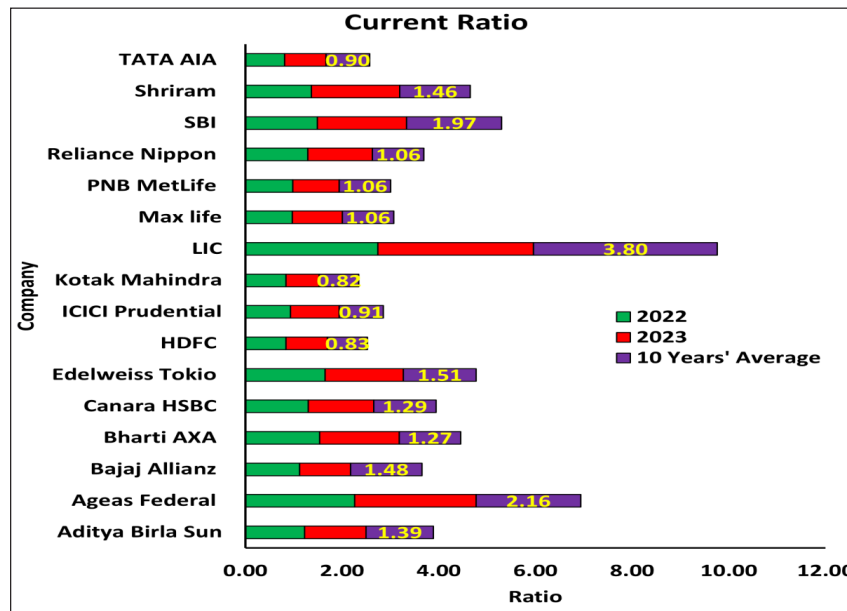
Table 4 : Liquidity Risk-Current Ratio

Company	Current Ratio ¹			
	2022	2023	10 Years' Average ²	Rank ²
Aditya Birla SunLife Insurance Company Limited	1.23	1.27	1.39	7
Ageas Federal Life Insurance Company Limited	2.26	2.51	2.16	2
Bajaj Allianz Life Insurance Company Limited	1.12	1.06	1.48	5
Bharti AXA Life Insurance Company Limited	1.54	1.64	1.27	9
Canara HSBC Life Insurance Company Limited	1.30	1.35	1.29	8
Edelweiss Tokio Life Insurance Company Limited	1.65	1.62	1.51	4
HDFC Life Insurance	0.84	0.86	0.83	15
ICICI Prudential Life Insurance	0.93	1.01	0.91	13
Kotak Mahindra Life Insurance	0.84	0.68	0.82	16
Life Insurance Corporation	2.74	3.22	3.80	1
Max life Insurance	0.97	1.03	1.06	11
PNB MetLife India Insurance Company Limited	0.98	0.97	1.06	12
Reliance Nippon Life Insurance Company Limited	1.30	1.33	1.06	10
SBI Life Insurance Company Limited	1.48	1.85	1.97	3
Shriram Life Insurance Company Limited	1.37	1.82	1.46	6
TATA AIA Life Insurance Company Limited	0.81	0.85	0.90	14

Source: ¹Compiled from the annual report. ²Author's Computation.

Table 4 presents the current ratios for various life insurance companies in India for the years 2022 and 2023, alongside their 10-year average current ratios and corresponding ranks. The current ratio is a financial metric used to assess a company’s liquidity and ability to meet its short-term financial obligations. A current ratio between 1.33:1 and 2:1 is generally considered healthy, indicating that the company has a good balance between current assets and liabilities. A ratio less than 1.33:1 may suggest a lower level of liquidity, while a ratio greater than 2:1 could indicate inefficient asset utilisation or an excess of idle cash. The ranks are assigned in descending order of the current ratio, which means that companies with higher current ratios are ranked at the top, while those with current ratios less than 1.33:1 are ranked lower. Life Insurance Corporation (Rank 1) and Ageas Federal Life (Rank 2) have current ratios above 2:1 with the highest 10-year average current ratio of 3.80 and 2.16, securing the top rank. These companies appear to have a

surplus of current assets relative to their current liabilities, indicating they might not be effectively utilising their resources or have a significant amount of idle cash. SBI Life, Shriram Life, Edelweiss Tokio Life, Bajaj, Aditya Birla Sun Life, Canara HSBC Life, and Bharti AXA Life Insurance Company Limited have current ratios within the healthy range, suggesting that they are adequately positioned to meet their short-term obligations without holding excessive idle cash. This reflects a balanced liquidity position. Max Life, ICICI Prudential, PNB MetLife India, Reliance Nippon, HDFC Life, TATA AIA Life, and Kotak Mahindra Life Insurance companies have current ratios below 1.33:1, indicating a relatively lower level of liquidity. This could potentially pose liquidity risk, especially during periods of financial stress, and they might need to review their current asset and liability management strategies. Chart 4 illustrates the data relating to the current ratio arranged in Table 4.



Source: Graphical representation of data using MS-Excel.

Chart 4: Current Ratio

The current ratio for the selected sample of life insurance companies for the years 2022 and 2023, alongside 10 years’

average has been illustrated by green-, red- and purple-coloured bars, respectively.

Table 5: Persistency Risk–Persistency Ratio

Company	Persistency Ratio ¹			Rank ²
	2022	2023	10 Years' Average ²	
Aditya Birla SunLife Insurance Company Limited	85.0%	87.0%	75.1%	9
Ageas Federal Life Insurance Company Limited	79.0%	80.0%	79.0%	7
Bajaj Allianz Life Insurance Company Limited	82.0%	82.0%	74.0%	10
Bharti AXA Life Insurance Company Limited	67.0%	69.0%	63.1%	16
Ca3nara HSBC Life Insurance Company Limited	85.0%	77.0%	76.2%	8
Edelweiss Tokio Life Insurance Company Limited	71.0%	75.0%	72.4%	13

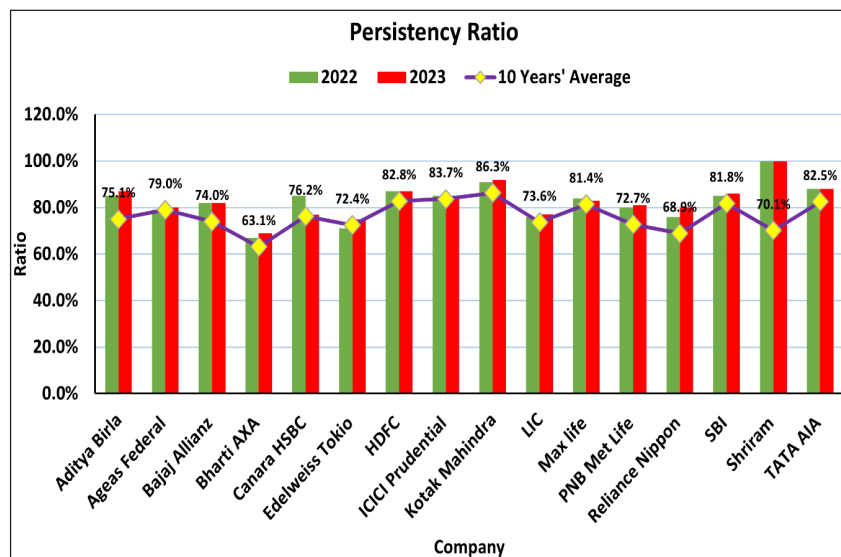
Company	Persistency Ratio ¹		10 Years' Average ²	Rank ²
	2022	2023		
HDFC Life Insurance	87.0%	87.0%	82.8%	3
ICICI Prudential Life Insurance	85.0%	85.0%	83.7%	2
Kotak Mahindra Life Insurance	91.0%	92.0%	86.3%	1
Life Insurance Corporation	76.0%	77.1%	73.6%	11
Max life Insurance	84.0%	83.0%	81.4%	6
PNB MetLife India Insurance Company Limited	80.0%	81.0%	72.7%	12
Reliance Nippon Life Insurance Company Limited	76.0%	80.0%	68.9%	15
SBI Life Insurance Company Limited	85.0%	86.0%	81.8%	5
Shriram Life Insurance Company Limited	100.0%	100.0%	70.1%	14
TATA AIA Life Insurance Company Limited	88.0%	88.0%	82.5%	4

Source: ¹Compiled from the annual report. ²Author's Computation.

The dataset in Table 5 presents the persistency ratios of selected insurance companies for the years 2022 and 2023, along with the 10 years' average and their respective ranks. Persistency ratio is a critical metric in the insurance industry that measures the ability of insurance companies to retain policyholders and collect premiums over a period of time. Higher persistency ratios are generally more favourable as they indicate a lower risk of policy lapses and better customer retention. The data presents a ranking of insurance companies based on their persistency ratios for the years 2023 and 2022. The rankings are assigned in a descending order, meaning that the company with the high persistency ratio are ranked in the top order while companies with lower persistency ratios are given lower ranks.

Kotak Mahindra Life Insurance Company (Rank 1) achieved the highest 10 years' average persistency ratio with an impressive rate of 86.3%. This indicates a strong ability to retain policyholders, placing it at the top rank. It has not only retained its policyholders effectively but also improved

slightly compared to the previous year. On the other end of the spectrum, Bharti AXA Life Insurance Company Limited had the lowest 10 years' average persistency ratio of 63.10%. This suggests that Bharti AXA Life faced challenges in retaining its policyholders, resulting in a persistency ratio significantly lower than other companies in the dataset. ICICIC, HDFC Life Insurance, Tata AIA, SBI Life, and Max Life Insurance Company Limited maintained their positions at the top of the ranks, with minimal changes in their persistency ratios, showcasing their ability to maintain a consistent customer base. Ageas, Aditya Birla, and LIC also remained stable in terms of their rankings, with modest improvements in their persistency ratios. Companies like Canara HSBC and Reliance Nippon Life Insurance Company Limited displayed varying performance with former experiencing a considerable decrease in the ratio and the latter improving its persistency ratio. The pictorial view of data for the years 2022 and 2023 has been depicted in Chart 5.



Source: Graphical representation of data using MS-Excel.

Chart 5: Persistency Ratio

The persistency ratios for the years 2022 and 2023, along with the 10 years’ average of the life insurance companies under observation have been exhibited by green, red, and purple color respectively.

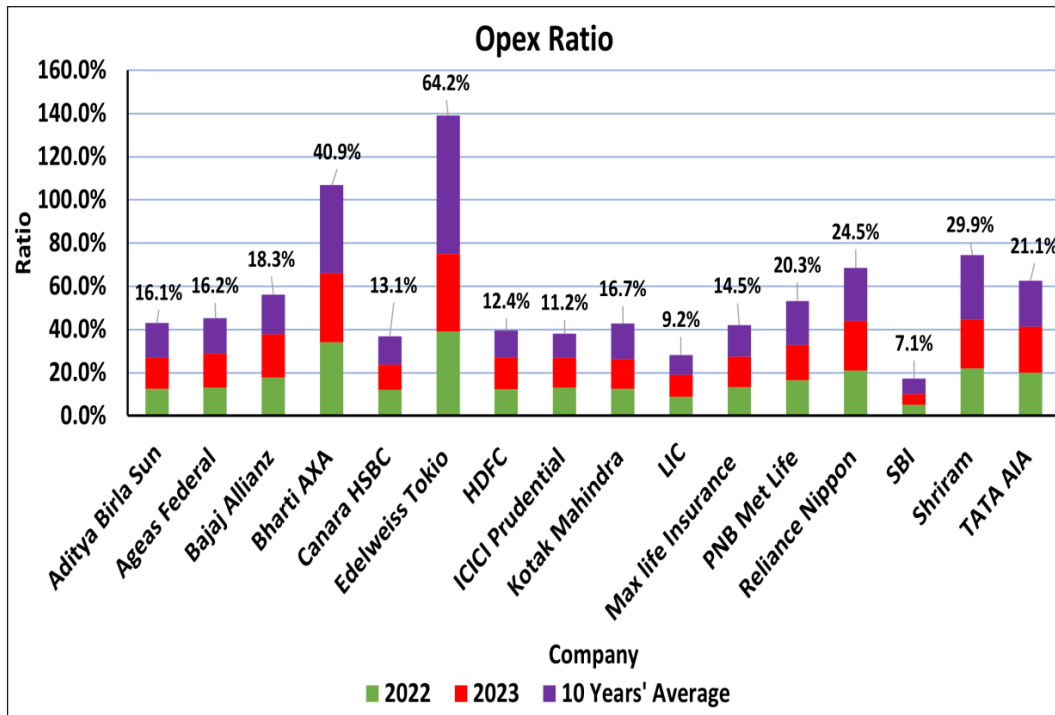
Table 6: Operational Risk – Opex Ratio

Company	Opex Ratio ¹		10 Years’ Average ²	Rank ²
	2022	2023		
Aditya Birla SunLife Insurance Company Limited	12.7%	14.2%	16.1%	7
Ageas Federal Life Insurance Company Limited	13.0%	16.0%	16.2%	8
Bajaj Allianz Life Insurance Company Limited	17.8%	20.0%	18.3%	10
Bharti AXA Life Insurance Company Limited	34.0%	32.0%	40.9%	15
Canara HSBC Life Insurance Company Limited	12.0%	11.8%	13.1%	5
Edelweiss Tokio Life Insurance Company Limited	39.0%	36.0%	64.2%	16
HDFC Life Insurance	12.3%	14.8%	12.4%	4
ICICI Prudential Life Insurance	13.0%	14.0%	11.2%	3
Kotak Mahindra Life Insurance	12.7%	13.4%	16.7%	9
Life Insurance Corporation	8.9%	10.1%	9.2%	2
Max life Insurance	13.3%	14.2%	14.5%	6
PNB MetLife India Insurance Company Limited	16.5%	16.5%	20.3%	11
Reliance Nippon Life Insurance Company Limited	21.0%	23.0%	24.5%	13
SBI Life Insurance Company Limited	5.1%	5.1%	7.1%	1
Shriram Life Insurance Company Limited	21.9%	22.7%	29.9%	14
TATA AIA Life Insurance Company Limited	20.1%	21.3%	21.1%	12

Source: ¹Compiled from the annual report. ²Author’s Computation.

Table 6 provides the data relating to the operating ratio of selected life insurance companies for the years 2022 and 2023, along with the 10 years’ average and corresponding ranks. The operating ratio is a key financial metric for assessing operational risk used to measure an insurer’s operational efficiency and can indicate its ability to manage costs and generate profits. The ranks assigned in the provided data are based on ascending order of the opex ratio, where companies with lower opex ratios are positioned at the top of the ranking, signifying superior operational efficiency, and conversely, companies with higher opex ratios are ranked lower, indicating lower operational efficiency. In 2023, the company with the highest operating ratio was Edelweiss Tokio Life Insurance Company Limited, with an operating ratio of 36% in 2023 and 39% in 2022. This high operating ratio (64.2%) over the past decade suggests that a significant portion of the company’s revenue is

being consumed by operating expenses. On the other hand, the company with the lowest operating ratio in 2022 and 2023 was SBI Life Insurance Company Limited, with an impressively low operating ratio of 5.1% in both the years and an average 7.1% in the past 10 years. This indicates that SBI Life Insurance is highly efficient in managing its operational costs and generating profits. Bharti AXA and Edelweiss Tokio Life Insurance company has slightly improved its Opex Ratio from 2022 to 2023, ranking at 15th and 16th position respectively. Max Life, Tata AIA and Shriram Insurance are staying at the 6th, 12th, and 14th rank, respectively, with a slight increase in their operating ratio, indicating steady performance. Ageas Federal Life Insurance displayed a significant increase in its operating expense ratio, rising from 13% in 2022 to 16% in 2023, standing at 8th rank on the basis of 10 years’ average ratio. Chart 6 gives a picture of the data grouped in Table 6.



Source: Graphical representation of data using MS-Excel.

Chart 6: Opex Ratio

The opex ratio of the life insurance companies under study for the years 2023 and 2022, along with 10 years' average opex ratio is depicted by green, red, and purple colored stacked bars, respectively.

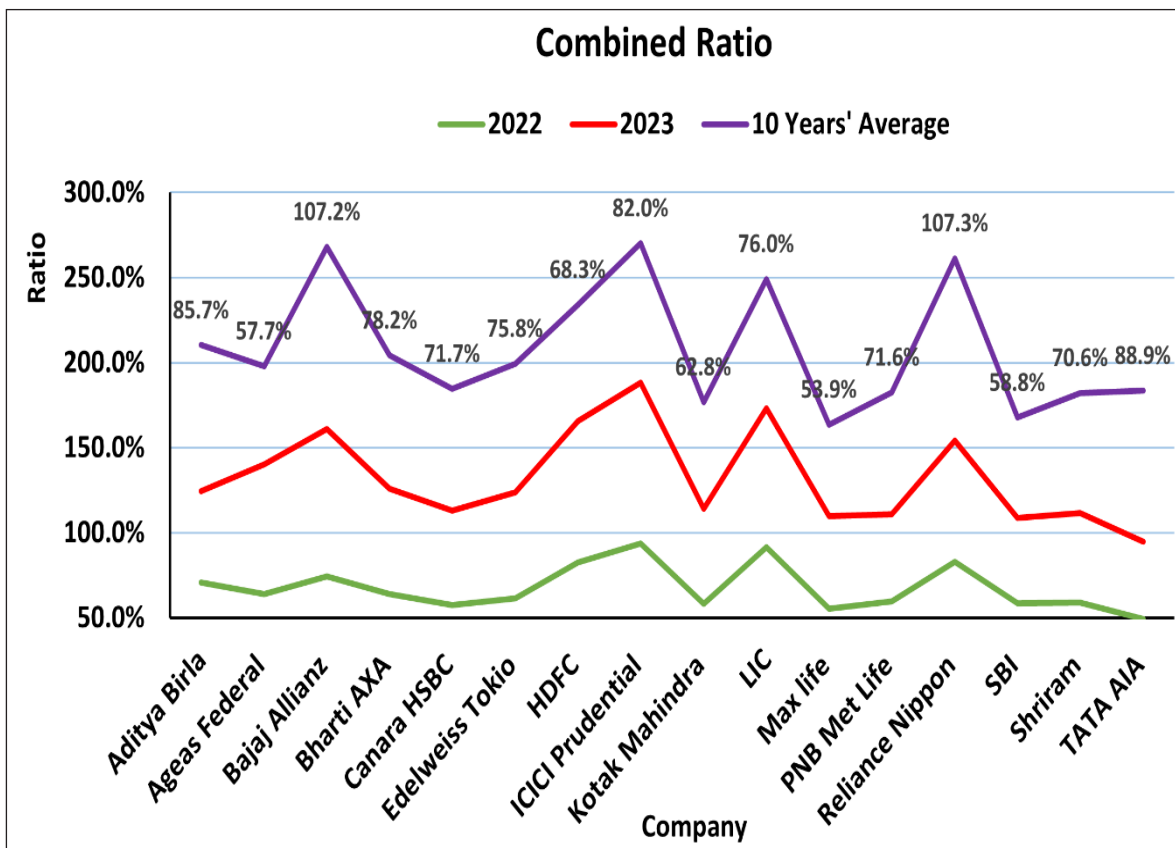
Table 7: Catastrophe Risk-Combined Ratio

Company	Combined Ratio ¹			Rank ²
	2022	2023	10 Years' Average	
Aditya Birla SunLife Insurance Company Limited	70.7%	53.9%	85.7%	13
Ageas Federal Life Insurance Company Limited	64.1%	76.2%	57.7%	2
Bajaj Allianz Life Insurance Company Limited	74.5%	86.4%	107.2%	15
Bharti AXA Life Insurance Company Limited	64.1%	61.9%	78.2%	11
Canara HSBC Life Insurance Company Limited	57.4%	55.6%	71.7%	8
Edelweiss Tokio Life Insurance Company Limited	61.3%	62.3%	75.8%	9
HDFC Life Insurance	82.5%	83.3%	68.3%	5
ICI Prudential Life Insurance	93.8%	94.4%	82.0%	12
Kotak Mahindra Life Insurance	58.2%	55.8%	62.8%	4
Life Insurance Corporation	91.6%	81.7%	76.0%	10
Max life Insurance	55.5%	54.3%	53.9%	1
PNB MetLife India Insurance Company Limited	59.6%	51.3%	71.6%	7
Reliance Nippon Life Insurance Company	83.0%	71.1%	107.3%	16
SBI Life Insurance Company Limited	58.6%	50.3%	58.8%	3
Shriram Life Insurance Company Limited	59.0%	52.7%	70.6%	6
TATA AIA Life Insurance Company Limited	49.4%	45.3%	88.9%	14

Source: ¹Compiled from annual report. ²Author's Computation.

Table 7 provides the combined ratios for various life insurance companies in India for the years 2022 and 2023, along with their 10-year average combined ratios and corresponding ranks. The combined ratio is a crucial metric in the insurance industry, especially for life insurance companies, as it indicates the overall financial health and ability to manage risks, including catastrophe risk. It is primarily used to assess the insurance company’s underwriting profitability. A combined ratio below 100% indicates that the company is making an underwriting profit, while a ratio above 100% suggests an underwriting loss. Max Life Insurance Company Limited holds the top position with the lowest 10-year average combined ratio of 53.9%, reflecting its efficient management of losses and expenses. Ageas Federal Life Insurance Company Limited follows closely with an average of 57.7%, placing it second. SBI Life Insurance Company Limited ranks third with a 10-year average of 58.8%. This indicates that the company was highly efficient in managing

its expenses relative to its premium income, suggesting a strong financial position and profitability. Kotak Mahindra Life Insurance was another company with a low combined ratio of 62.8% in the past decade, showing good control over their expenses compared to premium income. Bajaj Allianz and Reliance Nippon Life Insurance had a notably high combined ratio in the last 10 years, staggering at 107.2% and 107.3%, respectively. Ageas Federal, Edelweiss Tokio, ICICI Prudential, and Bajaj Allianz Life Insurance experienced an increase in its combined ratios from 2022 to 2023 indicating a similar trend of rising expenses in comparison to premium income. On the contrary, the combined ratio of Aditya Birla, Bharti AXA, Canara HSBC, and Kotak, LIC, Max Life, PNB, SBI Life, Shriram, and Tata AIA Life Insurance Company Limited have dropped slightly, potentially improving their profitability. These companies should maintain their underwriting discipline. Chart 7 graphically illustrates the data recorded in Table 7 for easy comprehension.



Source: Graphical representation of data using MS-Excel.

Chart 7: Combined Ratio

The combined ratio of the selected life insurance companies has been portrayed in the form of a line graph for the years

2023 and 2022 alongside 10 years’ average combined ratio by green, red, and purple colour respectively.

Hypothesis Testing

In this study, hypothesis-testing analysis using panel data regression through a pooling model has been conducted. The purpose of this analysis is to examine the impact of various risk management financial ratios on the dependent variable (persistency), which is an indicator of the performance and quality of business of the insurance companies. Specifically, we included Net Non-Performing Assets (NPA), Combined Ratio, Loss Ratio, Current Ratio, and Solvency Ratio as

independent variables.

Table 8 presents the statistical results of the regression model, including the estimates, standard errors, t-values, and p-values for each variable. These results provide insights into the significance and effect size of each predictor on the dependent variable. The statistical significance of the coefficients is assessed at conventional levels, and the p-values indicate whether the null hypothesis, which posits that the coefficient is equal to zero, can be rejected.

Table 8: Statistical Results of Panel Data Regression using Pooling Model

	Estimate	Std. Error	t-value	p-value	Remarks
(Intercept)	93.4456	2.2647	41.2620	0.0000***	
Net NPA	-5.5322	2.3773	-2.3271	0.0213*	Rejected
Combined Ratio	-0.3649	0.0381	-9.5849	0.0000***	Rejected
Loss Ratio	0.2264	0.0383	5.9192	0.0000***	Rejected
Current Ratio	-0.0081	0.0082	-0.9846	0.3264	Accepted
Solvency Ratio	-0.0004	0.0048	-0.0751	0.9402	Accepted
R ²	0.975				
F-statistics (Model Fit)	11.881				
p-value	0.000***				

Source: Author’s Compilation.

Note: *** indicates a p-value less than 0.001; ** indicates a p-value less than 0.01; * indicates a p-value less than 0.05.

Analysis of Individual Variables and Model Summary

- *Net NPA Ratio:* The coefficient is -4.234, indicating a negative relationship with the dependent variable. The p-value (0.0429) is less than 0.05, which means it is statistically significant at the 5% level. Therefore, we reject the null hypothesis for this variable, indicating that Net NPA Ratio has a significant impact on the dependent variable.
- *Combined Ratio:* The coefficient is -0.286, indicating a negative relationship with the dependent variable. The p-value (1.590e-11) is much less than 0.001, making it highly significant. We reject the null hypothesis for this variable, showing that Combined Ratio is a significant predictor.
- *Loss Ratio:* The coefficient is 0.197, indicating a positive relationship. The p-value (2.164e-07) is also much less than 0.001, making it highly significant. The null hypothesis is rejected for this variable, showing that Loss Ratio significantly affects the dependent variable.
- *Current Ratio:* The coefficient is -0.008, showing a very weak negative relationship. The p-value (0.3271)

is greater than 0.1, making it not significant. We fail to reject the null hypothesis for this variable, indicating it does not have a significant impact on the dependent variable.

- *Solvency Ratio:* The coefficient is 0.004, also indicating a very weak positive relationship. The p-value (0.4318) is greater than 0.1, making it not significant. We fail to reject the null hypothesis for this variable, indicating it does not have a significant impact on the dependent variable.

Model Summary

- *R-Squared:* 0.975 indicates that approximately 97.5% of the variance in the dependent variable is explained by the model. This is a very high value, suggesting the model fits the data well.
- *F-Statistic:* 11.8803 with a p-value of 0.000*** (1.212e-09) suggests that the overall model is statistically significant.

Table 8 summarises the significance of individual predictors in the regression model. Predictors with p-values below 0.05 (Net NPA, Combined Ratio, and Loss Ratio) were found to be statistically significant whereas predictors with

higher p-values (Current Ratio and Solvency Ratio) were not statistically significant.

FINDINGS, CONCLUSION, AND SUGGESTIONS

The comprehensive analysis of various financial performance and risk management metrics among different insurance companies strongly supports that the insurance companies with high solvency ratios, low Net NPA ratios, low loss ratios, healthy current ratios, and high persistency ratios consistently exhibit better financial performance and risk management (Wani & Ahmad, 2015). Conversely, companies with lower solvency ratios, higher Net NPA ratios, and operating expense ratios, as well as deteriorating combined ratios, tend to face challenges in maintaining their financial stability and profitability. Mazviona et al. (2017) revealed that both the expense ratio and claims ratio have a significantly negative impact on the performance of insurance companies. The research conducted by Thirupathi and Subhashini; Shahi and Agnihotri (2022) also provides valuable insights into the drivers of profitability for insurance companies, particularly in the Indian context. The study offers valuable perspectives on the challenges and opportunities facing the Indian insurance industry, including issues related to regulatory compliance, risk management practices, and industry performance metrics (Kaur Bawa & Chattha, 2013; Kumari, 2013). The study emphasises the importance of transparency and accountability in risk management disclosures for fostering trust among stakeholders and enhancing the overall financial performance of the insurance industry.

Thus, the empirical evidence strongly supports the rejection of the null hypothesis, which assumes *no significant relationship between financial performance and risk management disclosures*. Instead, the alternative hypothesis, asserting a significant relationship between these factors, is supported by the strong empirical evidence from the analysis of the insurance companies' data. This emphasises the vital role of effective risk management strategies in shaping the financial performance and overall success of insurance companies (Wani & Ahmad, 2015). Hence, by elucidating the interplay between effective risk management strategies and financial outcomes, the objective of this research to testify that the effective risk management disclosures have a profound influence in enhancing the financial stability and overall performance of the life insurance companies has been accomplished.

Suggestions

The suggestions provided aim to enhance the financial stability and performance of insurance companies, particularly in the context of solvency, credit risk, morbidity risk, liquidity, persistency, operational efficiency, and combined ratios. It is suggested that to enhance their overall performance, insurance companies should prioritise specific areas identified through the analysis of various ratios. Strengthening financial resilience emerges as a critical focus; companies like Aditya Birla SunLife could strengthen their solvency ratios, while others, such as Reliance Nippon Life Insurance, might mitigate high combined ratios through improved underwriting and expense management (Joo, 2013). Elevating customer retention rates is imperative; firms like Ageas Federal Life Insurance could augment persistency ratios to cultivate enduring client relationships. Moreover, optimising risk management practices, like reducing loss ratios as recommended for HDFC Life Insurance, and refining liquidity, such as enhancing current ratios for TATA AIA Life Insurance, are essential for ensuring overall stability and competitiveness. Tailoring strategies to address specific challenges and capitalise on strengths will be paramount for sustained profitability and market standing in the insurance industry.

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IMPACT ANALYSIS OF BASEL III NORMS ON THE PROFITABILITY OF INDIAN PUBLIC SECTOR BANKS

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Abstract *The banking sector of an economy is a prominent sector as it assists the flow of financial resources to productive sectors. The financial crisis of 2008 impelled the Basel Committee on Banking Supervision (BCBS) to introduce Basel III norms in the year 2010 to make banks more resilient during any such financial crisis. Using two key financial indicators—Return on Assets (ROA) and Return on Equity (ROE), this study seeks to evaluate the profitability of Indian public sector banks subsequent to the enforcement of Basel III regulations. This study is based on 12 Indian public sector banks and uses data from the years 2009 to 2023. This study found that public sector banks in India saw a decline in profitability after being exposed to Basel III regulations, although there has been an improvement since 2022. The author recommended that there must be close monitoring of the adoption of Basel III by the financial regulators.*

Keywords: *Public Sector Banks (PSBs), Basel III, Profitability, Return on Assets (ROA), Return on Equity (ROE)*

INTRODUCTION

The progress and prosperity of a nation depend on its stable financial sector. A strong and stable financial system is denoted by the strong, liquid, and profitable banking sector. These factors enable the banking system to cope with any kind of financial crisis. The Indian banking system follows international capital regulations to ensure a strong and resilient banking system. When it comes to India's banking system, the public sector banks are kingmakers. The Reserve Bank of India is the regulatory body that regulates the whole Indian banking system. Numerous mergers and consolidations within India's public sector banks have been successfully completed in recent years. As a result, there are now 12 public sector banks in operation across the nation. Therefore, in this study, we focus on only these 12 public sector banks of India.

As a wing of the Bank for International Settlement (BIS), the Basel Committee for Banking Supervision (BCBS) is vested with the exclusive responsibility of managing global banking standards. In 1988, the Basel Committee established the Basel I standards for the international banking system. In 2004, they were followed by Basel II, and in 2010, Basel III.

The financial turmoil of 2008 was the main reason behind the introduction of the Basel III Accord to improve risk management and transparency in the banking system. The period for implementation of Basel III norms was from 2013 to 2018. In India, the deadline for Basel III implementation has been extended many times, and due to COVID-19, it is further extended till July 2022. The Basel III norms are an advanced form of Basel II norms. The main features of Basel III are:

- The Tier 1 capital went up from 4% to 6%.
- Common equity to risk-weighted assets increased from 2.5% to 4.5%.
- An additional capital conservation buffer is to be maintained at 2.5%.
- Reserve of 0% to 2.5% of total risk-weighted assets for counter-cyclical purposes.
- Two New Ratios: Net Stable Funding Ratio and Liquidity Coverage Ratio.
- A Leverage Ratio of at least 3% is required for all banks.

The purpose of the Basel III standards is to strengthen and fortify the banking system in anticipation of an unforeseen

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financial crisis. The Indian public sector banks are performing well in compliance with new Basel norms. The purpose of this research is to evaluate the effect of Basel III on the profitability of India's public sector banks.

REVIEW OF LITERATURE

This segment offers a thorough examination of several studies pertaining to the Basel III regulations and their influence on the performance of banks.

Roman and Danuletiu (2013) examined commercial banks in Romania to identify the profitability factors and the period of the study from 2003 to 2011. Commercial banks' profitability is found to be significantly impacted by bank-specific variables such as asset quality, liquidity, and management quality. Additionally, external factors such as the rate of economic expansion and the concentration of banks have an effect on the profitability of banks.

Adam (2014) analysed the financial performance of Iraq's Erbil Bank from 2009 to 2013 using a range of performance metrics. The research findings indicated that there is an improvement in profitability ratios, asset quality ratios, and liquidity ratios, which indicates the good financial health of Erbil Bank. It is suggested that banks should develop some banking operations to enhance their financial performance and profitability.

Islam (2014) examined the National Bank Limited of Bangladesh from 2008 to 2013 by using some financial ratios. It is concluded that an unstable economic environment has harmed the financial performance of NBL Bank in the last few years. But if we compare NBL's performance with other banks, it is quite good. It is also found that the bank has diversified its portfolio in the last few years.

Titko et al. (2015) examined the various factors of bank profitability in Latvia and Lithuania for the years 2008 to 2014. This study uses financial and non-financial factors for analysis. The author concluded that the profitability of the Latvian and Lithuanian Banking sectors is positively affected by bank size, e-banking services, and developed infrastructure while it is negatively affected by the operational efficiency of banks.

Menicucci and Paolucci (2016) examined 28 European banks from 2006 to 2015 to find out how internal factors affected their profitability. The findings of this study indicate that European banks' profitability is impacted positively by CAR and the size of the bank. It is also observed that the Return on Equity is positive for those banks that attain higher deposit ratios. However, the assets quality ratio harms profitability.

Islam and Rana (2017) analyse the variables that influence the profitability of Bangladesh's private commercial banks. This investigation is conducted on fifteen banks from 2005 to 2015. The research findings indicate that operating expenses and non-performing loans are the primary determinants of a bank's profitability. Moreover, these variables significantly impact the profitability of Bangladeshi banks.

Kumar and Kavita (2017) assessed the financial health of selected public and private banks in India for the period 2009-2016. The study concluded that all selected banks are financially sound and healthy. Although, there is little variation in the financial performance of both sector banks. The author suggested that banks should follow a regular monitoring system to assess their financial position.

Maiti and Jana (2017) analysed the factors affecting the profitability of five Indian bank groups: foreign banks, the State Bank of India and its associates, nationalised banks, and old and new private banks. The findings show that NPA, non-interest income, NIM, and profit per employee affect the profitability of all groups. It is also concluded that banks should focus on reducing the NPA with the help of a strict credit policy and a strong debt collection policy.

Mehta and Bhavani (2017) evaluated how various factors, both internal and external, affected the profitability of the UAE banking sector. The study analyses the data from 19 UAE banks from 2006-2013. The study's results indicate that banks' profitability is greatly impacted by the higher capital adequacy ratio, cost efficiency, and improved asset quality. It is hereby suggested that banks should use a profitability-enhancing model to improve their financial performance.

Nuhiu et al. (2017) discovered how the financial performance of banks in Kosovo was affected by profitability determinants during 2010-2015. This study uses financial parameters such as Net Interest Margin, Return on Assets, and Return on Equity. According to the results, the financial performance of banks is highly impacted by management efficiency and asset quality. However, it is negatively impacted by capital adequacy and liquidity but GDP and inflation have an insignificant impact on it.

Zaky and Soliman (2017) examined the effects of Basel III on commercial banks in Egypt between 2013 and 2016. According to the results, small banks are highly impacted by Basel III as compared to large banks, and banks with higher capital adequacy, a higher leverage ratio, and higher profitability are less impacted by these norms as compared to lower capital adequacy, lower leverage, and less profitable banks.

Almaqtari et al. (2018) studied the factors that led to the profitability of commercial banks in India between 2008

and 2017 by looking at their ROA and ROE. Several ratios were found to have a positive effect on Return on Equity, including liquidity, bank size, assets management, and asset quality. The results indicate that a higher Return on Equity is associated with larger banks, better asset management, higher asset quality, and higher liquidity ratios. It is found that several factors affect Return on Assets, including interest rate, demonetisation, currency rate, and inflation.

Kumar and Kavita (2018) examined financial data from 2007-2017 to ascertain the impact of Basel III standards on the performance of public sector banks in India. It has been found that the financial health of Indian PSBs has worsened after the adoption of Basel III which is shown by a decline in both Return on Assets and Return on Equity. Additionally, this results in a reduction in the profitability of banks operating in the public sector.

Rekik and Kalai (2018) examined the determinants of efficiency and profitability of 110 conventional banks in 14 countries from 1999-2012. The findings reveal that banks should improve their asset quality, management quality, and bank size to boost their profitability. The author suggested that there will be more focus on profit efficiency rather than cost efficiency.

Abbas et al. (2019) compared the American and Asian banking sectors from 2011 to 2017 to find out how capital, liquidity, and credit risk affected the profitability of commercial banks. As per the results, bank capital has a similar impact on the profitability of American and Asian banks. Credit risk has a greater effect on the profits of American commercial banks than their Asian counterparts. While commercial banks in Asian economies benefit from a high liquidity level, their American counterparts see a decline in profitability.

Ali and Dhiman (2019) explored the relationship between profitability and credit risk management of Indian commercial banks during the time frame from 2010 to 2017. The results indicate that the return on assets of commercial banks is positively associated with capital adequacy, earnings, and management quality. However, liquidity and asset quality had a negative effect on the profitability of commercial banks in India.

Bunea and Dinu (2019) examined 27 banks from Romania to ascertain how Basel III will affect the financial stability and solvency of Romanian banks and the period covered in this study is 2014-2018. It is concluded that the Romanian banking sector is maintaining its solvency ratio above the prescribed limit. The author concluded that the final impact of Basel III can be assessed after the full implementation of these norms.

Rajput and Sankaran (2019) studied 21 public sector banks in India from 2007-2018 to examine Basel III's impact on these banks. In order to measure profitability, this study utilised Return on Assets and Return on Equity. The research showed that public sector banks in India are seeing a decline in profitability as a result of Basel III.

Ramesh (2019) investigated the factors affecting the return on assets and return on equity of 39 commercial banks in India for the period 2009-2017. According to the study, the capital adequacy ratio affects Indian commercial banks' return on assets but does not affect the return on equity. Non-interest revenue and net interest margin boost Indian commercial banks, while NPAs and intermediation costs to total assets hurt them. The author suggested that commercial banks should adopt a stringent credit system to reduce the heavy burden on NPAs.

Biswas and Bhattacharya (2020) undertook an analysis of the performance of 10 Indian private banks that are considered to be of the new generation during the period of time spanning from 2015 to 2019. It has been noted that the performance of each of the selected banks varies greatly from one another. Among all of the selected banks, the Bandhan Bank is at the top, followed by the HDFC Bank.

Le et al. (2020) conducted an analysis to determine how effective the capital requirements of Basel III were for the profitability of banks in the United Kingdom and Australia between the years 2000 and 2019. It is concluded that the strict capital norms under Basel III are unable to enhance the bank's profitability and efficiency. A higher capital ratio weakens the bank's performance. The study also revealed that the performance of UK Banks is better than Australian Banks.

Agarwal et al. (2021) examined the impact of non-performing assets on the profitability of scheduled commercial banks in India for the period 2008-2018. According to the findings, investors' confidence in banks is eroded as a result of non-performing assets' detrimental impact on the profitability of scheduled banks. The author suggests that banking regulators should focus on the reduction of bad loans. Another finding is that commercial bank's capital adequacy and net interest margin are positively associated.

Lileikiene et al. (2021) analysed the performance of European and US banks after the introduction of Basel III. The findings revealed that strict capital and liquidity norms under Basel III reduced the profitability of banks. It is evident that adherence to these norms brings stability to the financial system but banks have to face an additional burden of cost which negatively impacts their profitability.

Obadire et al. (2022) identified the effect of Basel III on the bank's efficiency from six African nations. For this purpose, data for the period between 2010-2019 from 45 banks in six African countries have been used. The study concluded that the capital ratio and liquidity ratio under Basel III positively impact the efficiency of African banks. It is observed that African banks are efficient enough to handle any kind of crisis.

Pervez et al. (2023) examined the effect of risk and capital adequacy standards on the efficiency of commercial banks in India. The study includes 65 banks from the public, private, and foreign sectors, and the period was 2005 to 2018. According to the results, Indian commercial banks are negatively impacted by the CAR and NNPA. Additionally, compared to private and international banks, public sector banks are hit much harder.

OBJECTIVE OF THE STUDY

This study's overarching goal is to determine how the Basel III standards have affected the profitability of public sector banks in India. The Return on Assets (ROA) and Return on Equity (ROE) of PSBs were analysed to conduct this impact assessment.

In light of the study's objective, the subsequent hypotheses are developed.

H₀₁: There is no significant difference in the ROA of PSBs during the pre-Basel III era and the post-Basel III era.

H₀₂: There is no significant difference in the ROE of PSBs during the pre-Basel III era and the post-Basel III era.

METHODOLOGY

The current study makes use of secondary data acquired from the annual reports of banks. In this study, descriptive and analytical approaches have been utilised to assess the effect of Basel III regulations on bank profitability. The analysis is carried out using MS Excel and SPSS. In order to assess the profitability of banks, data spanning the period from 2009 to 2023 was gathered from 12 public sector banks. The profitability of public sector banks is assessed through the Return on Assets (ROA) and Return on Equity (ROE).

Return on Assets (ROA) shows the net income generated on total assets. The efficiency of management and the overall performance of an organisation can be judged with the help of this ratio. The higher ROA indicates a good profitability position and efficient use of assets. A lower ROA states

that the bank needs more funds to continue its operations further as the investment is high. ROA of more than 5 % is considered good. ROA is computed as:

$$\text{Return on Assets (ROA)} = \left[\frac{\text{Profit after tax}}{\text{Total assets}} \right] * 100$$

Return on Equity (ROE) indicates the return on investment. This is the proportion of equity to net profit. The higher ROE indicates the efficiency of management in generating income and growth. ROE of more than 10 to 20 % is generally considered profitable. ROE is computed as:

$$\text{Return on Equity (ROE)} = \frac{\text{Profit after tax}}{\text{Total equity}}$$

RESULTS AND DISCUSSION

The results of this study shed light on the change that has occurred in the Return on Assets and Return on Equity of public sector banks in India over the course of the past 15 years. To gauge how the Basel III standards have affected Indian public sector banks, it examines their financial performance using the profitability indicators ROA and ROE. The current status of ROA and ROE of Indian PSBs is also highlighted in this study. The result and discussion have been done in the following parts:

- Impact of Basel III on the Profitability of Indian Public Sector Banks.
- Status of ROA and ROE of Indian PSBs during 2023.
- Impact of Basel III on the Profitability of Indian Public Sector Banks.

As per RBI guidelines, India adopted Basel III norms on April 1, 2013. The implementation process of these norms requires a longer time; therefore, RBI gave time up to March 2018, which was later extended many times by RBI till the time, and the last extension was up to July 2022. These norms will affect the profitability of banks, so it becomes necessary to examine the effect of the Basel III accord on the profitability position of PSBs. The period from 2009 to 2023 has been taken under this study. The years 2009 to 2013 have been taken as the pre-Basel III era and the year from 2014 to 2023 are considered the post-Basel III era. This study examined the financial health of all public sector banks using two pivotal metrics of profitability: Return on Assets and Return on Equity.

The ROA and ROE of the last 15 years are under two sections by dividing the overall period into pre-Basel III era (2009-2013) and post-Basel III era (2014-2023).

- ROA of PSBs during Pre-Basel III and Post-Basel III

Table 1: ROA (%) of PSBs during Pre-Basel III (2009-2013)

Public Sector Banks	2009	2010	2011	2012	2013
Bank of Baroda	0.98	1.1	1.18	1.12	0.82
Bank of India	1.33	0.7	0.82	0.72	0.65
Bank of Maharashtra	0.72	0.7	0.47	0.55	0.74
Canara Bank	0.94	1.3	1.42	0.95	0.77
Central Bank of India	0.45	0.66	0.7	0.26	0.44
Indian Bank	1.62	1.67	1.53	1.31	1.02
Indian Overseas Bank	1.09	0.53	0.59	0.47	0.23
Punjab National Bank	1.39	1.44	1.34	1.19	1
Punjab & Sind Bank	1.26	1.05	0.9	0.65	0.44
State Bank of India	1.04	0.88	0.71	0.88	0.97
UCO Bank	0.59	0.87	0.66	0.69	0.33
Union Bank of India	1.27	1.25	1.05	0.68	0.69

Source: Annual Report of Banks.

Table 1 shows the ROA of Indian PSBs before the adoption of Basel III norms. An analysis of all public sector banks reveals that their Return on Assets (ROA) was positive

during these five years. Hence, it can be concluded that the profitability of public sector banks was good before implementing Basel III norms.

Table 2: ROA (%) of PSBs during Post-Basel III (2014-2023)

Public Sector Banks	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Bank of Baroda	0.69	0.48	-0.8	0.2	-0.34	0.06	0.05	0.07	0.57	0.97
Bank of India	0.51	0.27	-0.94	-0.24	-0.91	-0.84	-0.43	0.28	0.43	0.49
Bank of Maharashtra	0.3	0.33	0.07	-0.86	-0.73	-3.01	0.23	0.3	0.55	1.1
Canara Bank	0.54	0.55	-0.52	0.2	-0.75	0.06	-0.32	0.23	0.48	0.81
Central Bank of India	-0.47	0.21	-0.48	-0.8	-1.61	-1.7	-0.35	-0.26	0.3	0.44
Indian Bank	0.67	0.54	0.36	0.67	0.53	0.12	0.26	0.47	0.63	0.77
Indian Overseas Bank	0.21	-0.15	-1.05	-1.38	-2.54	-1.49	-3.27	0.3	0.59	0.76
Punjab National Bank	0.64	0.53	-0.61	0.19	-1.6	-1.25	0.04	0.15	0.26	0.18
Punjab & Sind Bank	0.35	0.13	0.34	0.2	-0.69	-0.47	-0.91	-2.55	0.85	0.98
State Bank of India	0.65	0.68	0.46	0.41	-0.19	0.02	0.38	0.48	0.67	0.96
UCO Bank	0.7	0.48	-1.25	-0.75	-1.88	-1.84	-0.96	0.06	0.34	0.62
Union Bank of India	0.48	0.47	0.33	0.12	-1.08	-0.6	-0.53	0.27	0.5	0.69

Source: Annual Report of Banks.

The Table 2, provides insights into the ROA of PSBs after implementing Basel III norms. It is observed that public sector banks witnessed a decline in ROA after 2013. Many PSBs recorded negative ROA from 2014 to 2021. The years

2022 and 2023 show improvement in the ROA of all public sector banks.

- ROE of PSBs during Pre-Basel III and Post-Basel III

Table 3: ROE (%) of PSBs during Pre-Basel III (2009-2013)

Public Sector Banks	2009	2010	2011	2012	2013
Bank of Baroda	19.48	22.19	21.48	19.11	14.59
Bank of India	25.51	14.76	8.9	15.63	13.62
Bank of Maharashtra	21.93	21.43	15.85	11.45	16.19
Canara Bank	20.64	24.09	22.43	18.75	14.03
Central Bank of India	16.38	24.25	23.62	5.96	8.58
Indian Bank	22.72	23.39	21.62	18.91	15.14
Indian Overseas Bank	22.31	11.13	13.13	-1.02	-0.55
Punjab National Bank	23.52	24.59	22.13	18.52	15.19
Punjab & Sind Bank	30.65	21.06	14.6	11.14	7.7
State Bank of India	15.07	14.04	12.84	14.36	15.94
UCO Bank	19.95	28.02	18.06	17.93	8.6
Union Bank of India	24.79	23.55	18.79	13.67	13.68

Source: Annual Report of Banks.

From Table 3, it can be seen that the Return on Equity for the majority of banks was positive before Basel III, except for Indian Overseas Banks, which showed negative ROE during 2012 (-1.02%) and 2013 (0.55%). Based on this table, we

can deduce that; Indian public sector banks were in a good state in terms of profitability before the adoption of Basel III norms.

Table 4: ROE (%) of PSBs during Post-Basel III (2014-2023)

Public Sector Banks	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Bank of Baroda	13	9.21	-17.64	4.53	-7.64	1.18	1.23	1.5	11.82	18.34
Bank of India	11.82	6.7	-25.39	-7.78	-31.07	-24.57	-12.41	8.81	10.55	10.31
Bank of Maharashtra	6.75	6.73	1.34	-22.23	-11.52	-109.56	4.09	5.02	11.45	20.38
Canara Bank	10.59	11.06	-10.69	4.15	-16.74	1.4	-8.05	6.71	12.82	19.49
Central Bank of India	-10.24	3.87	-9.85	-14.12	-28.38	-29.79	-5.23	-4.08	3.79	6.21
Indian Bank	10.04	8	5.27	9.72	8.31	2	3.94	11.88	10.52	14.73
Indian Overseas Bank	4.19	-3.26	-21.85	-29.5	-47.45	-22.84	-52.78	4.9	7.43	17.39
Punjab National Bank	9.69	8.12	-11.2	3.47	-32.85	-24.2	0.58	2.41	5.96	3.94
Punjab & Sind Bank	6.24	2.16	5.62	3.27	-12.03	-9.53	-17.7	-32.67	7.41	22.18
State Bank of India	10.49	11.17	7.74	7.25	-3.78	0.48	7.74	9.94	13.92	19.43
UCO Bank	14.36	9.52	-30.35	-19.94	-59.36	-37.75	-14.45	0.96	4.45	17.14
Union Bank of India	9.99	9.73	6.84	2.86	-27.99	-15.57	-12.52	6.68	7.94	13.26

Source: Annual Report of Banks.

Table 4, the ROA of PSBs during the last years has been presented. The ROE of public sector banks shows a decline along with a negative ROE for some Indian PSBs from 2014 to 2021. There was an improvement in the ROE of Indian

PSBs from 2022 onward. Therefore, it can be concluded that the ROE of public sector banks is negatively impacted by Basel III norms.

Table 5: Average Return on Assets of PSBs during Pre-Basel III and Post-Basel III

Public Sector Bank	Mean ROA during the Pre-Basel III Era (2009-2013)	Mean ROA during the Post-Basel III Era (2014-2023)
Bank of Baroda	1.04	0.20
Bank of India	0.84	-0.14
Bank of Maharashtra	0.64	-0.17

Public Sector Bank	Mean ROA during the Pre-Basel III Era (2009-2013)	Mean ROA during the Post-Basel III Era (2014-2023)
Canara Bank	1.08	0.13
Central Bank of India	0.50	-0.47
Indian Bank	1.43	0.50
Indian Overseas Bank	0.58	-0.80
Punjab National Bank	1.27	-0.15
Punjab & Sind Bank	0.86	-0.18
State Bank of India	0.90	0.45
UCO Bank	0.63	-0.45
Union Bank of India	0.99	0.07

Source: Author's compilation.

According to Table 5, all public sector banks had a positive average ROA prior to Basel III. Four PSBs, namely Canara Bank, Indian Bank, Bank of Baroda, and Punjab National Bank had a mean ROA of more than 1%, and other PSBs also maintained a mean ROA of more than 0.5%. But during the post-Basel III era, many banks like the Indian Overseas Bank, PNB, Punjab & Sind Bank, UCO Bank,

Bank of Maharashtra, Central Bank of India, and Bank of India have negative mean ROA. The ROA of other PSBs also deteriorates after Basel III adoption. Hence, it is concluded that the Return on Assets has gone down after the adoption of Basel III, which indicates that Basel III norms negatively impacted the profitability of Indian public sector banks.

Table 6: Summary Statistics of ROA of PSBs during the Pre- and Post-Basel III Era

Groups	Count	Sum	Average	Variance
Pre-Basel III period (2009-2013)	12	10.76	0.896	0.080
Post-Basel III period (2014-2023)	12	-1.04	-0.08	0.145

Sources: Author's calculation.

Table 6 describes the summary statistics of ROA of PSBs during the pre-Basel III era and the post-Basel III era. A t-test is employed to determine whether there is a statistically significant difference between the Return on Assets of public banks during pre- and post-Basel III.

Since the p-value is less than 0.001, as shown in Table 7, which is less than 0.050, we can reject H₀₁. Therefore, it can be inferred that the average ROA of public sector banks during the two time periods [pre-Basel III and post-Basel III] differs significantly.

Hypothesis Testing

H_{01} : There is no significant difference in the ROA of PSBs during the pre-Basel III era and the post-Basel III era.

Table 7: T-Test

	ROA during the Pre-Basel III Era	ROA during the Post-Basel III Era
Mean	0.89	-0.08
S.D.	0.28	0.38
Observations	12	12
Df	11	
T Stat	13.37	
P value (two-tailed)	<0.001	

Sources: Author's calculation.

Table 8: Average Return on Equity of PSBs during pre-Basel III and Post-Basel III

Public Sector Bank	ROE [Pre-Basel III Era (2009-2013)]	ROE [Post-Basel III Era (2014-2023)]
Bank of Baroda	19.37	3.55
Bank of India	15.68	-5.30
Bank of Maharashtra	17.37	-8.76
Canara Bank	19.99	3.07
Central Bank of India	15.76	-8.78
Indian Bank	20.36	8.44
Indian Overseas Bank	9.00	-14.38
Punjab National Bank	20.79	-3.41
Punjab & Sind Bank	17.03	-2.51
State Bank of India	14.45	8.44
UCO Bank	18.51	-11.54
Union Bank of India	18.90	0.12

Source: Author's compilation.

From Table 8, it is observed that the ROE of all PSBs was good during the pre-Basel III era, but there was a decline in ROE during the post-Basel III era. There is a negative

change in the Return on Equity of all public sector banks which stipulates that Basel III norms adversely affect the financial health of PSBs.

Table 9: Summary Statistics of ROA of PSBs during Pre and Post-Basel III Era

Groups	Count	Sum	Average	Variance
Pre-Basel III period (2009-2013)	12	207.21	17.26	10.83
Post-Basel III period (2014-2023)	12	-31.04	-2.58	56.72

Sources: Author's calculation.

In Table 9, we can see the overall statistics of the Return on Equity (ROE) of PSBs before and after Basel III. With the use of a t-test, we are trying to determine if the return on equity (ROE) of PSBs was significantly different during pre- and post-Basel III.

Hypothesis Testing

H_{02} : There is no significant difference in the ROE PSBs during the Basel III era and the post-Basel III era.

Table 10: T-Test

	ROE during the Pre-Basel III Era	ROE during the Post-Basel III Era
Mean	17.26	-2.58
S.D	3.29	7.53
Observations	12	12
Df	11	
T Stat	10.42	
P value (two-tailed)	<0.001	

Sources: Author's calculation.

According to Table 10, we can reject H_{02} because the p-value (<0.001) is smaller than 0.050. Consequently, a notable disparity exists in the average Return on Equity (ROE) value among public banks during the two time periods pre- and post-Basel III.

Status of ROA and ROE of Indian PSBs during 2023

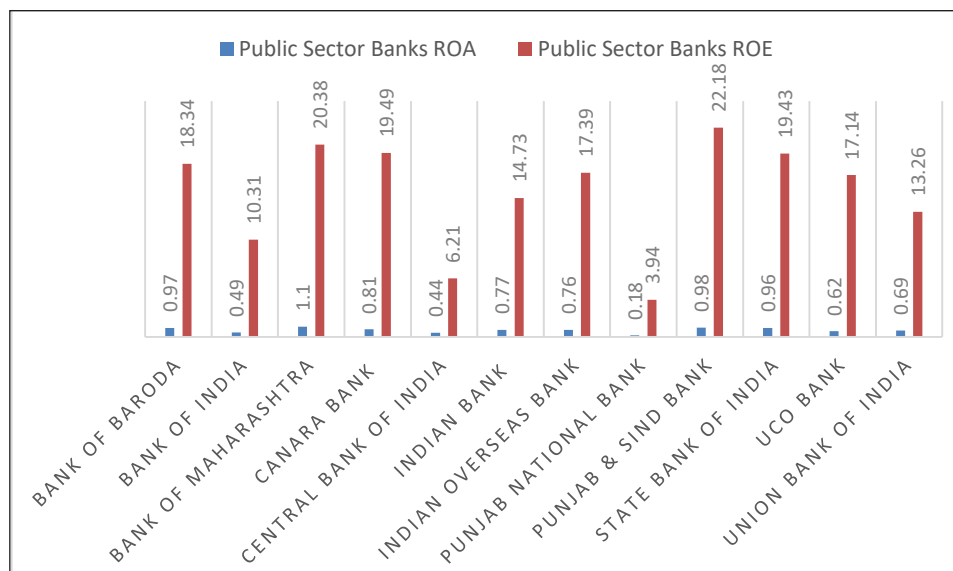
Table 11: Return on Assets (ROA) and Return on Equity (ROE) of PSBs in 2023

Public Sector Bank	ROA	ROE
Bank of Baroda	0.97	18.34
Bank of India	0.49	10.31
Bank of Maharashtra	1.1	20.38
Canara Bank	0.81	19.49
Central Bank of India	0.44	6.21
Indian Bank	0.77	14.73
Indian Overseas Bank	0.76	17.39

Public Sector Bank	ROA	ROE
Punjab National Bank	0.18	3.94
Punjab & Sind Bank	0.98	22.18
State Bank of India	0.96	19.43
UCO Bank	0.62	17.14
Union Bank of India	0.69	13.26

Source: Annual Report of Banks.

Table 11 shows the Return on Assets (ROA) and Return on Equity (ROE) of PSBs for the year 2023. It is observed that all public sector banks recorded positive ROA in the current year. The highest ROA is maintained by Bank of Maharashtra (1.1%), followed by Punjab & Sind Bank (0.98%) and Bank of Baroda (0.97%). In 2023, public sector banks will also have a positive Return on Equity. Punjab & Sind Bank (22.18%) recorded the highest ROA among all PSBs, followed by Bank of Maharashtra (20.38%) and Canara Bank (19.49%). Two public sector banks, namely Punjab National Bank (0.18% and 3.94%) and Central Bank of India (0.44% and 6.21%), have the lowest ROA and ROE.



Source: Author's Compilation.

Fig. 1: ROA and ROE of PSBs in 2023

From Fig. 1, we can observe that in 2023 all public sector banks will have positive ROA and ROE. This chart shows that the highest ROA is recorded for the Bank of Maharashtra and the lowest is for Punjab National Bank. Punjab & Sind Bank topped in attaining the highest ROE, while Punjab National Bank has the lowest ROE in 2023.

CONCLUSION

In this study, profitability analysis of public sector banks of India has been done, and how Basel III norms impacted these banks is also examined. In this study, it is observed that the present level of both Return on Assets (ROA), as well as Return on Equity (ROE) of all public banks, is quite good as compared to the last few years. The years 2022 and 2023 show positive increments in the ROA and ROE of PSBs. It is observed that the profitability of PSBs was satisfactory over the period 2009-2013. However, Indian public sector banks are facing a decline in Return on Assets and Return on Equity during the post-Basel III era, which indicates the poor financial health of banks. After implementing Basel III, return on assets (ROA) and return on equity (ROE) both fall, suggesting that the standards have a negative impact on banks' profitability. The Basel III norms impose high capital requirements and additional funding costs for public sector banks, and due to these strict norms, public sector banks are facing deterioration in their profitability. Therefore, it is concluded that the Basel III Accord has an adverse effect on the profitability of public sector banks in India.

LIMITATIONS OF THE STUDY

This study is limited to only Indian public sector banks. There are just two measures of profitability, Return on Assets and Return on Equity. There are some other indicators also which can be used. This study covers only profitability analysis while ignoring other factors that affect a bank's profitability.

POLICY IMPLICATIONS

The findings of this study will assist banking stakeholders and policymakers in getting insight into the extent to which the profitability of public sector banks is impacted by Basel III. As the ROA and ROE of PSBs have improved since 2022, the author suggests that banks should focus on maintaining this trend in the future. It is also recommended that banking regulators should make sure that all parameters of Basel III are fulfilled by banks, before implementing further reforms.

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TURNING LEMONS INTO LEMONADE: MEDIATING COLLABORATIVE INNOVATION THROUGH DIGITAL TRANSFORMATION FOR SUSTAINABLE ENTREPRENEURSHIP

Sadananda Sahoo*, Saumendra Das**, A. Chiranjibi Rambabu Achary***, Rohit Bansal****

Abstract *This study employs structural equation modelling and a 5-point Likert scale to examine the relationship among Digital Transformation, Collaborative Innovation, and Sustainable Entrepreneurship. Utilising Variance Inflation Factors (VIF) for collinearity assessment, the inner model demonstrates stable construct relationships despite moderate VIF values. When collinearity is evaluated using Variance Inflation Factors (VIF), the inner model shows robust construct correlations even with moderate VIF values. The results of path coefficient analysis show that collaborative innovation and digital transformation have a major, beneficial impact on sustainable entrepreneurship. The psychometric assessments ensure the reliability and validity of the constructs in the measurement model. The model selection of the study based upon Bayesian Information Criterion (BIC), sustains the efficacy of models, incorporating Collaborative Innovation and Sustainable Development by accentuating their critical charities to accomplish a frugal and effective model fit, vibrant for understanding multifarious phenomena. Specifically, f-square values highlight the practical significance of effect size measurements. Overall, this study offers a clear knowledge of the connections between these important concepts, which will be helpful for practitioners and policymakers as they promote sustainable entrepreneurship through collaborative innovation and digital transformation.*

Keywords: *Digital Transformation, Collaborative Innovation, Sustainable Entrepreneurship, Structural Equation Modelling, 5-Point Likert Scale*

JEL Classification: *O31, O33, L26*

INTRODUCTION

The contemporary business landscape is shaped by the relentless march of technological progress, with digital transformation at its forefront. In this era, entrepreneurs are not only steering traditional business challenges but also harnessing the transformative potential of digital technologies to foster sustainable entrepreneurship. Entrepreneurship, as a small-scale ventures, plays an important role in sustaining economies by reducing unemployment, producing jobs, and nurturing innovation and creativity, accordingly confirming economic sustainability and fortune (Upadhaya

& Chadha, 2019). This paper gets on a journey to explore the intricate interplay between digital transformation, collaborative innovation, and the imperative of sustainable entrepreneurship. In a world where lemons are aplenty, we seek to elucidate how they can be turned into lemonade through a mediating force of collaborative innovation in the digital age.

Context and Significance of the Study

The onset of the digital era has unleashed waves of innovation and disruption across industries. Traditional

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business models are being reshaped, and entrepreneurs are continually pressed to adapt to the evolving landscape. Technology expansion leads to systems development and is thrived by technology acceptance, as it expedites enriched information management and productivity, fuelling organisational synergy and client offerings (Changati & Kansal, 2019). Digital transformation, marked by the integration of digital technologies into all aspects of business, offers unprecedented opportunities for entrepreneurs to streamline operations, expand markets, and enhance customer experiences. Yet, it also presents formidable challenges as entrepreneurs steer a landscape of rapid technological change, cybersecurity threats, and the need to balance profit-seeking with environmental and societal responsibility. One of the prominent consequences of digital transformation is its capacity to facilitate and amplify collaborative innovation. Enterprises no longer operate in silos; they engage in open collaborations, co-creation, and knowledge sharing. This phenomenon is not merely a choice but a strategic necessity for thriving in an interconnected world.

At the heart of this research lies the question of how digital transformation acts as a catalyst for collaborative innovation and, in turn, mediates the path to sustainable entrepreneurship. The significance of this study lies in its potential to offer entrepreneurs, policymakers, and business leaders understandings into harnessing digital technologies to navigate challenges and convert adversity into advantage. It provides a roadmap for leveraging collaborative innovation as a bridge to sustainable entrepreneurship, addressing not only financial viability but also societal and environmental impact. The journey ahead takes us through a nuanced exploration of the digital transformation phenomenon, the dynamics of collaborative innovation, and the dimensions of sustainable entrepreneurship. We will investigate the links, synergies, and mediating effects that underpin this triad, offering a comprehensive understanding of how, in a world teeming with lemons, lemonade can be the result.

LITERATURE REVIEW

Digital Transformation in Entrepreneurship

The surge of digital technologies has undeniably transformed the business landscape. Scholars such as Westerman et al. (2014) emphasise that digital transformation entails more than just adopting the latest technology; it necessitates a

holistic reshaping of business models and processes to fully exploit the potential of these innovations. Digital transformation, as described by Iansiti and Lakhani (2020), fundamentally alters the way firms create and capture value, making it a pivotal force in contemporary entrepreneurship. The impact of digital transformation transcends industries, affecting sectors from traditional manufacturing to service-based domains (Bharadwaj et al., 2013).

Collaborative Innovation in the Digital Age

Digital transformation has brought about a paradigm shift in innovation. Collaborative innovation has emerged as a key driver of success in this landscape. Chesbrough (2003) introduced the concept of open innovation, highlighting the value of external collaboration. Recent research by Bauer and Prado (2020) further underscores the role of digital platforms in facilitating open innovation and breaking down silos. As firms increasingly engage with ecosystems of partners, including startups, customers, and suppliers, the process of innovation becomes distributed, rapid, and responsive to market needs (Marcon, 2021).

Sustainable Entrepreneurship in the Modern Era

Sustainable entrepreneurship is not merely a trendy buzzword but a critical approach to business. Literature reveals the intersection of sustainability and entrepreneurship as a complex yet rewarding endeavour. Schaltegger et al. (2017) define sustainable entrepreneurship as the pursuit of opportunities to create value through novel solutions that address environmental and social challenges. Halme et al. (2020) argue that sustainable entrepreneurship goes beyond corporate social responsibility, encompassing practices that enhance economic, environmental, and social dimensions. Small and Medium-sized Enterprises (SMEs) play a decisive role by spawning employment, accumulating value, and contributing to innovation, particularly in developing countries (Hendieh, 2023). Notably, social and environmental objectives do not compete with profitability but complement it, a concept often referred to as the triple bottom line (Elkington, 1997). MSMEs produce extensive employment and afford entrepreneurial opportunities to the people in both rural and urban areas (Sulthana, Subrahmanyam & Habibullah, 2022).

Digital Transformation as a Catalyst for Collaborative Innovation and Sustainable Entrepreneurship

Digital transformation has demonstrated its potential as a mediator between innovation and sustainable entrepreneurship. This transformative power lies in its ability to break down geographical and organisational boundaries (Boudreau & Lakhani, 2009). As enterprises become digitally connected ecosystems, collaborative innovation flourishes. These alliances, driven by digital tools and platforms, serve as conduits for co-creating solutions that are both innovative and sustainable. Rogers (1995) accentuated four key aspects affecting technology acceptance: the innovation itself, communication channels, timing of implementation, and societal attitudes towards adoption (Changati & Kansal, 2019).

The literature paints a picture of a dynamic and interrelated triad, where digital transformation plays the role of an enabler, collaborative innovation is the intermediary force, and sustainable entrepreneurship represents the ultimate goal. However, to navigate this landscape successfully, it is essential to understand the nuances, synergies, and challenges that underpin these concepts.

STATEMENT OF THE PROBLEM

In an era marked by unprecedented digital transformation, entrepreneurs are increasingly embracing collaborative innovation to foster sustainable entrepreneurship. However, despite substantial research in individual domains (digital transformation, collaborative innovation, and sustainable entrepreneurship), there exists a gap in our understanding of the interconnected dynamics of these concepts, particularly the mediating role of digital transformation in the collaborative innovation process. This research aims to address this gap by investigating how digital transformation mediates and influences collaborative innovation within the context of sustainable entrepreneurship, ultimately contributing to a more holistic understanding of the contemporary entrepreneurial landscape. We formulate a series of succinct research questions (RQs) to direct our investigation and serve as the foundation for our empirical analysis.

RQ1: Is there a positive and significant relationship between the level of digital transformation and sustainable entrepreneurship?

RQ2: Does collaborative innovation mediate the relationship between digital transformation and sustainable entrepreneurship?

RQ3: Does collaborative innovation have a positive and significant impact on sustainable entrepreneurship?

THEORETICAL UNDERPINNINGS AND ORIGINATION OF HYPOTHESES

The theoretical framework for this research is founded on several key concepts and models that underpin the study. These frameworks provide a structured lens through which we analyse the interplay of digital transformation, collaborative innovation, and sustainable entrepreneurship. This theoretical framework provides a comprehensive basis for investigating the complex relationships and processes at the intersection of digital transformation, collaborative innovation, and sustainable entrepreneurship.

Digital Transformation and Sustainable Entrepreneurship

As technology spreads, the Indian government lifts focus on the digital infrastructure of enterprises where innovation is a variable which has an affirmative influence on entrepreneurs. (Arora & Kaur, 2018). Digital transformation stands out as a major force in the evolution and advancement of entrepreneurial endeavours. It involves the incorporation of digital technologies and procedures to enhance effectiveness, enhance customer interactions, and boost competitiveness within diverse industries and domains. Entrepreneurs have the opportunity to harness digital transformation to devise novel business models, products, services, and innovations tailored to market demands and standards. Digital transformation encompasses e-commerce, cloud computing, artificial intelligence, block chain, and the internet of things.

The theoretical foundation for the intersection of “Digital Transformation” and “Sustainable Entrepreneurship” draws from well-established theories. The Resource-Based View (RBV) theory, as articulated by Barney (1991), emphasises the pivotal role of digital transformation in enhancing an organisation’s resource base and adaptability. The Open Innovation Framework, a concept introduced by Chesbrough (2003), offers a valuable understanding of how digital technologies can foster open collaborations and align with institutional pressures for sustainability.

H1: There is a positive and significant relationship between digital transformation and sustainable entrepreneurship.

Digital Transformation and Collaborative Innovation

Digital Transformation and Collaborative Innovation are grounded in theories such as the Resource-Based View and Open Innovation. The former emphasises digital capabilities as resources, while the latter underscores the value of external collaborations. Dynamic Capabilities theory contributes to understanding adaptability in a changing environment, with digital transformation enhancing these capabilities. In parallel, Collaborative Innovation theory elucidates the process of collaborating with external partners for innovation. All of these theories play a vital role in shaping Sustainable Entrepreneurship, where digital transformation and collaborative innovation can foster economic, environmental, and social sustainability (Schaltegger & Wagner, 2011).

H2: There is a positive and significant relationship between digital transformation and Collaborative innovation.

Collaborative Innovation and Sustainable Entrepreneurship

A current and notable trend in the sphere of entrepreneurship development and innovation revolves around the surging prominence of collaborative innovation. Collaborative innovation is a multifaceted process that encompasses the collaborative co-creation, co-development, and co-delivery of solutions in tandem with a diverse spectrum of stakeholders. These stakeholders can include customers, suppliers, strategic partners, competitors, and local communities. The essence of collaborative innovation empowers entrepreneurs to tap into a rich mosaic of perspectives, a reservoir of diverse skill sets, access to varied resources, and an intricate web of interconnected networks.

The Open Innovation Theory suggests that Innovation Ecosystems facilitate collaborative innovation by promoting knowledge sharing and co-creation among diverse ecosystem actors (Chesbrough, 2003). This collaboration, in turn, can enhance Sustainable Entrepreneurship by providing access to external knowledge, resources, and complementary capabilities. The Triple Helix Model highlights the interaction between universities, industries, and governments within innovation ecosystems, fostering collaborative innovation that can drive sustainability-focused entrepreneurial activities (Etzkowitz & Leydesdorff, 2000).

H3: Collaborative Innovation has a positive and significant impact on sustainable entrepreneurship.

Mediating Role of Collaborative Innovation

The examination of the mediating role of Collaborative Innovation between Digital Transformation and Sustainable Development draws from established literature. According to Chesbrough (2003), the Open Innovation Framework sheds light on the value of external collaboration and highlights how digital transformation can facilitate open collaborations. Therefore, it becomes essential to explore the interplay and mediating effects of Collaborative Innovation within the context of digital transformation and sustainable development, keeping in mind the nuances, synergies, and challenges that underpin these concepts.

H4: Collaborative innovation mediates the relationship between digital transformation and sustainable entrepreneurship.

Building upon the theoretical foundations discussed above, we have illustrated the study's proposed conceptual model in Fig. 1.

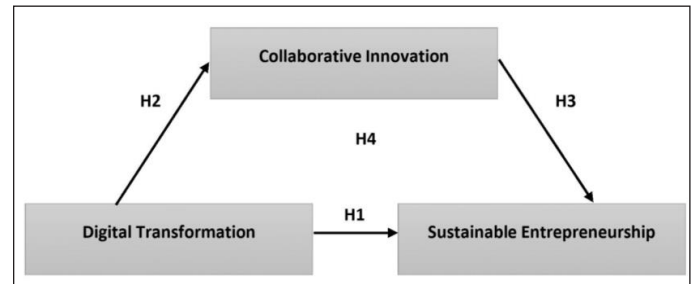


Fig. 1: Hypothesised Model

METHODS

This research examines the complex dynamics of digital transformation, collaborative innovation, and sustainable entrepreneurship by employing a quantitative approach.

Data Collection

The study collected data from 106 active participants who took part in an entrepreneurship conclave titled “MSME CONCLAVE-INDUSTRY ACADEMIA MEET” hosted through a collaborative effort by MSME-DFO, Cuttack, DIC Rayagada, and Atal Community Innovation Centre (ACIC)-GIETU University on August 31, 2023. Data collection was facilitated through a Google Form e-questionnaire that incorporated a 5-point Likert scale for participants to express

their opinions and perceptions. Following meticulous scrutiny and examination of the collected data, responses from 97 participants were deemed suitable for inclusion in the study.

Data Analysis

The research employed two software tools, SPSS 26 and Smart PLS, to conduct data analysis. These tools allowed for systematic data processing and robust statistical examination of the research constructs. Various statistical techniques were applied to measure variables, explore relationships, and test hypotheses. The quantitative analysis approach was chosen for its ability to provide a comprehensive view of the phenomenon under investigation.

Measurement Instruments

During the scale-development process, a comprehensive eighteen item scale was created to measure the three dimensions of entrepreneurship. The survey instruments featured a 5-point Likert scale, where participants were asked to express their opinions and perceptions by selecting a response that ranged from “1 - Strongly Disagree” to “5 - Strongly Agree.” 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree), and 5 (strongly agree).” This scale was chosen to allow participants to provide nuanced feedback on various aspects of entrepreneurship.

Collaborative Innovation

The Collaborative Innovation scale utilised in this research is specifically designed to assess individuals’ proclivity for engaging in collaborative innovative behaviours and practices. This measurement tool employs a six-item scale. Higher scores on this scale denote a heightened level of engagement and alignment with collaborative innovation initiatives, whereas lower scores indicate a reduced degree of involvement in such activities. The sample items included from the scale were, to what extent has collaborative innovation positively mediated the relationship between digital transformation and sustainable entrepreneurship within your organisation? To what extent does your organisation involve customers and end-users in the innovation process through digital channels, contributing to sustainable entrepreneurship? And so on. The scale confirmed good internal consistency, yielding a Cronbach’s alpha value of 0.916.

Digital Transformation

The study developed a seven-item scale based on research using a 5-point scale, spanning from “1: strongly disagree” to “5: strongly agree”. Elevated scores indicate greater levels of digital entrepreneurship, whereas lower scores indicate lesser levels of digital entrepreneurship. Sample items included, like, to what extent has digital transformation facilitated collaborative innovation in your organisation? Has digital transformation significantly impacted the sustainability of your entrepreneurial venture? How well does your organisation leverage digital transformation to foster collaborative innovation with external partners and stakeholders? The scale has been validated in multiple studies with Cronbach’s alpha values fluctuating from 0.6 to 0.8 (Hirschi, 2009). A Cronbach alpha of 0.894 is achieved for this scale, indicating good internal consistency.

Sustainable Entrepreneurship

The sustainable entrepreneurship scale consists of a collection of six items, which have been derived and modified from existing literature (Nhemachena & Murimbika, 2018). Respondents are provided with these items and are asked to rate their agreement using a 5-point Likert scale. Participants evaluate their degree of concordance with the statements for each of these items. Sample items included, like: How important is environmental sustainability to your organisation’s overall mission and business strategy? How well does your organisation integrate sustainability criteria into its product and service development processes? To what extent does your organisation engage in responsible sourcing and ethical supply chain management for sustainability?. However, 0.932 is the Cronbach’s alpha for the scale, indicating even higher internal consistency.

Hypothesis Testing

Hypotheses derived from the theoretical framework are tested using appropriate statistical tests. The analysis seeks to establish whether digital transformation significantly influences collaborative innovation, whether collaborative innovation mediates the relationship between digital transformation and sustainable entrepreneurship, and the extent of these effects.

Data Validation and Reliability

To ensure the validity and reliability of the research findings, statistical techniques such as factor analysis and Cronbach’s

alpha are applied to assess the internal consistency of the measurement scales.

DATA ANALYSIS: RESULTS AND DISCUSSION

The data gathered from the questionnaires underwent analysis through Smart PLS4 software. All the construct values set the satisfactory cut-off value of 0.7, as suggested by Nunnally (1978). The seven-item Digital Transformation (DIGT), six-item Collaboration Innovation (COLB), and five-item sustainable entrepreneurship (SUST) produce the *Cronbach's alpha values* for scale as 0.894, 0.916, and 0.932, respectively (shown in Fig. 2). The scale was prepared to commence the acquisition of comprehensive empirical data for the research investigation.

The primary goal of this research was to predict the dependent variable sustainable entrepreneurship (SUST), widely used in SEM research (Hussain & Li, 2022). This was achieved using a two-stage SEM approach, following the model proposed by Hair, Ringle, and Sarstedt (2013). In the first stage, a thorough measurement model assessment was performed to evaluate construct validity and goodness of fit. After confirming a satisfactory measurement model, the study proceeded to the second stage, employing Structural Equation Modelling (SEM) to empirically represent the structural relationships between different constructs through path estimates.

Before validating the measurement model, an exploratory factor analysis (EFA) was conducted as a preliminary step

to ensure meaningful factor loadings for measured variables and to reveal the underlying relationships between measured variables and their respective constructs.

Exploratory Factor Analysis

Kaiser-Meyer-Olkin (KMO) and Bartlett's Sphericity tests are applied to assess sample adequacy for factor analysis, and the obtained values were deemed adequate. The approximate chi-square value was 1246.663 with 153 degrees of freedom, significant at the 5 percent level of significance. The Kaiser-Meyer-Olkin (KMO) statistic yielded a value of 0.856, which exceeds the suggested threshold of 0.50 (Hair et al., 2013) as presented in Table 1.

Table 1: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.856
Bartlett's Test of Sphericity	Approx. Chi-Square	1246.663
	df	153
	Sig.	.000

Source: Author's estimation.

Measurement Model Assessment

The measurement model in the factor analysis displays the relationship between constructs and indicators, incorporating Composite Reliability (CR) to assess internal consistency and reliability, and Average Variance Extracted (AVE) to evaluate convergent validity (Sarstedt et al., 2014).

Table 2: Convergent Validity Test of Measurement Mode-Cronbach's Alpha, Composite Reliability, and Average Variance Extracted (AVE)

Constructs	Cronbach's Alpha	Composite Reliability (Rho_A)	Composite Reliability (Rho_c)	Average Variance Extracted (AVE)
Collaborative Innovation	0.916	0.939	0.933	0.700
Digital Transformation	0.894	0.908	0.916	0.610
Sustainable Development	0.932	0.949	0.948	0.786

Source: Author's estimation.

According to Gaskin and Lim, 2016, the model is considered excellent if the values of AVE are greater than 0.5 and CR exceed 0.7. As observed in Table 2, the standards of CR, and AVE meet these criteria, affirming the model's reliability

and validity. The convergent validity of each critical success factor was assessed using AVE, while reliability was tested using CR.

Table 3: Outer Loadings of Items of the Constructs

Items of the Constructs	Collaborative Innovation	Digital Transformation	Sustainable Development
COLB1 <- Collaborative Innovation	0.932		
COLB 2 <- Collaborative Innovation	0.956		
COLB 3 <- Collaborative Innovation	0.841		

Items of the Constructs	Collaborative Innovation	Digital Transformation	Sustainable Development
COLB 4 <- Collaborative Innovation	0.982		
COLB 5 <- Collaborative Innovation	1.055		
COLB 6 <- Collaborative Innovation	1.166		
DIGT1 <- Digital Transformation		1.000	
DIGT 2 <- Digital Transformation		0.955	
DIGT 3 <- Digital Transformation		1.052	
DIGT 4 <- Digital Transformation		1.056	
DIGT 5 <- Digital Transformation		0.842	
DIGT 6 <- Digital Transformation		0.960	
DIGT 7 <- Digital Transformation		1.062	
SUST1 <- Sustainable Development			1.041
SUST2 <- Sustainable Development			1.015
SUST3 <- Sustainable Development			0.991
SUST4 <- Sustainable Development			0.985
SUST5 <- Sustainable Development			0.969

Source: Author’s estimation

The purpose of the model is to assess the appropriateness and suitability of the utilised scales. For individual item reliability, each item’s outer loadings are evaluated and it is found that outer loading values are higher than 0.70 (Sarstedt et al., 2014). It is also found in Table 3 that each

item’s outer loadings are more than 0.70, indicating the sufficiency of standards for the item’s loading. The three-factor measurement model and structural model are depicted in Figs. 2 and 3, respectively.

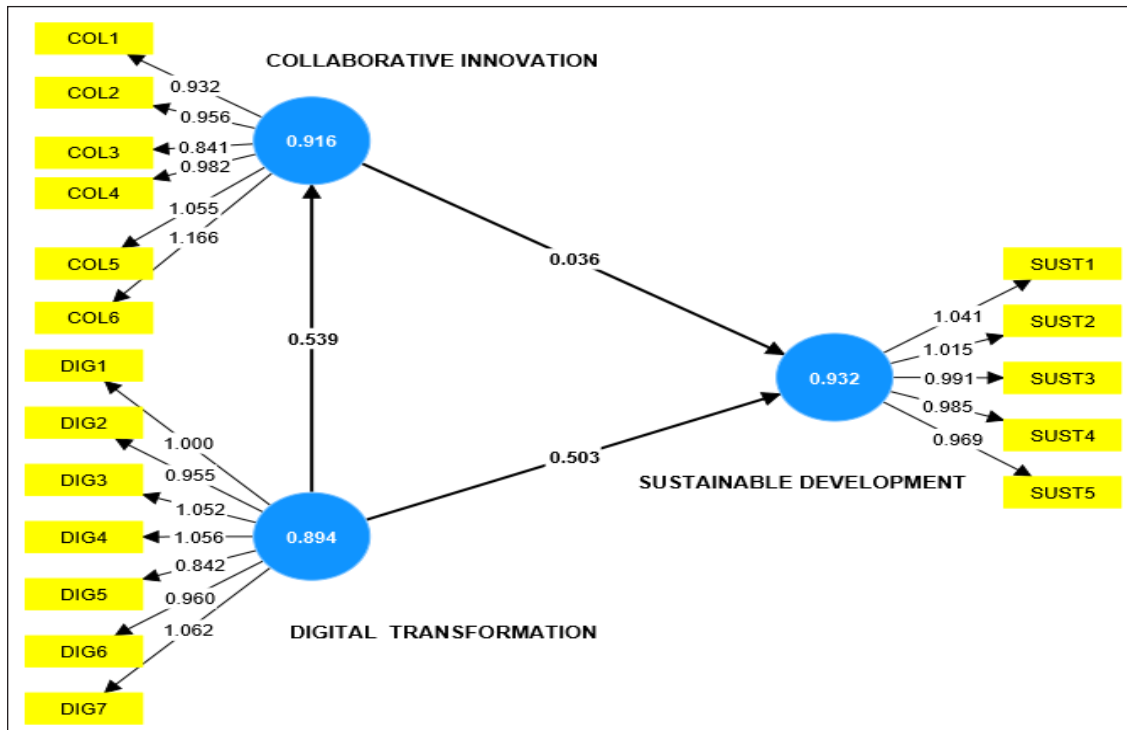


Fig. 2: Three Factor Measurement Model

Discriminant Validity

Discriminant validity is evident among all the study constructs. To validate this, the Heterotrait-Monotrait (HTMT) technique proposed by Fornell and Larcker (1981) was utilised, which evaluates discriminant validity by analysing the inter-correlations between a specific construct of interest and all other indicators in the model values below 0.85 indicate the achievement of discriminant validity (Kline, 2015). HTMT values close to 1 indicate lack of discriminant validity. Table 4 fulfils the HTMT ratio procedure, with all values in the matrix being less than 0.85 for inter-construct correlations. The HTMT Ratio-coefficients associated with each of the latent variables varied from 0.171 to 0.398, all of which are below the threshold value of 0.85, given in Table 4. There were no indications of any issues or concerns with this HTMT analysis, as specified by Gaskin and Lim (2016).

Table 4: HTMT Ratio-Coefficients

HTMT Ratio-Coefficients	Coefficients of Heterotrait-Monotrait Ratio (HTMT)
The Latent Variables	
Digital Transformation <-> Collaborative Innovation	0.398
Sustainable Development <-> Collaborative Innovation	0.171
Sustainable Development <-> Digital Transformation	0.379

Structural Model Assessment

The structural model describes the paths relationships between the endogenous variable and the exogenous variable in the conceptual research model. In the structural modelling, we assessed the presence of multicollinearity using Variance Inflation Factor (VIF) values, a measure that quantifies the degree of correlation among predictor variables. According to established literature, multicollinearity is considered problematic when VIF exceeds a threshold of 5 (Hair, Ringle & Sarstedt, 2013). Table 5 depicts the VIF values of the individual items, which are less than 5.

Table 5

Items	VIF
COLB1	3.193
COLB2	2.988
COLB3	3.197
COLB4	2.573

Items	VIF
COBL5	2.656
COLB6	2.384
DIGT1	2.202
DIGT2	2.41
DIGT3	2.375
DIGT4	2.314
DIGT5	1.646
DIGT6	1.89
DIGT7	1.936
SUST1	4.028
SUST2	3.937
SUST3	2.906
SUST4	3.144
SUST5	2.888

Source: Author’s estimation.

Variance Inflation Factors (VIF) for collinearity statistics among constructs in the inner model is examined in Table 6. The VIF values close to 1 indicate that there is little to no multicollinearity among the constructs in the inner model. This is a positive finding that the relationships between Digital Transformation, Collaborative Innovation, and Sustainable Development can be independently examined without the interference of high multicollinearity.

Table 6: Collinearity Statistics of the Structural Model

Constructs	VIF
Collaborative Innovation -> Sustainable Development	1.171
Digital Transformation -> Collaborative Innovation	1.000
Digital Transformation -> Sustainable Development	1.171

A standard bootstrapping technique is used to determine the implication of path coefficients, p-values, t-values, and the value of R². The approach involved employing 5000 bootstrap samples methodologies (Reinartz et al., 2009; Hair et al., 2014). A good model should have an SRMR (Standardized Root Mean Square Residual) value of less than 0.08 (Henseler et al., 2016; Hair et al., 2014), given in Table 7. In this study, the SRMR value is 0.079, which is lower than the threshold, signifying a good model fit. SRMR is a statistic that measures the discrepancy between the estimated model and the observed data. In this case, the SRMR value is 0.079 (Table 7). A lower SRMR value indicates a better fit to the data. An SRMR of 0.079 suggests that the estimated model provides a relatively good fit to the data, as it is a relatively small value.

The d_OLS (Unweighted Least Squares) value of 1.005 is a measure of the fit of the estimated model. It is compared to a baseline model. In this case, a value of 1.005 suggests that the estimated model is not significantly worse than the baseline model in terms of fit.

Table 7: Model Fit Indices

Model Fit Indices	Saturated Model	Estimated Model
SRMR	0.079	0.079
d_OLS	1.005	1.005
d_G	0.525	0.525
Chi-square	279.212	279.212
NFI	0.792	0.792

Source: Author’s estimation.

The d_G (GFI Incremental Fit Index) of 0.525 is another measure of the incremental fit of the estimated model compared to a baseline model. A value of 0.525 suggests that

the estimated model is providing a reasonable improvement over the baseline model. The chi-square value of 279.212 is a statistic used to assess how well the estimated model fits the data (Table 7). Lower chi-square values indicate better fit. In this case, the chi-square value is 279.212, which suggests that the estimated model fits the data, but it’s important to note that chi-square values are often affected by sample size, so they should be interpreted in the context of the specific analysis.

NFI (Normed Fit Index) value of 0.792 is a normed fit index that measures how well the estimated model reproduces the observed data (Table 7). A value of 0.792 suggests that the model provides a reasonable fit to the data, although higher values are generally desired. The estimated model appears to provide a relatively good fit to the data. The SRMR, d_OLS, d_G, and NFI values all suggest that the model is fitting the data reasonably well.

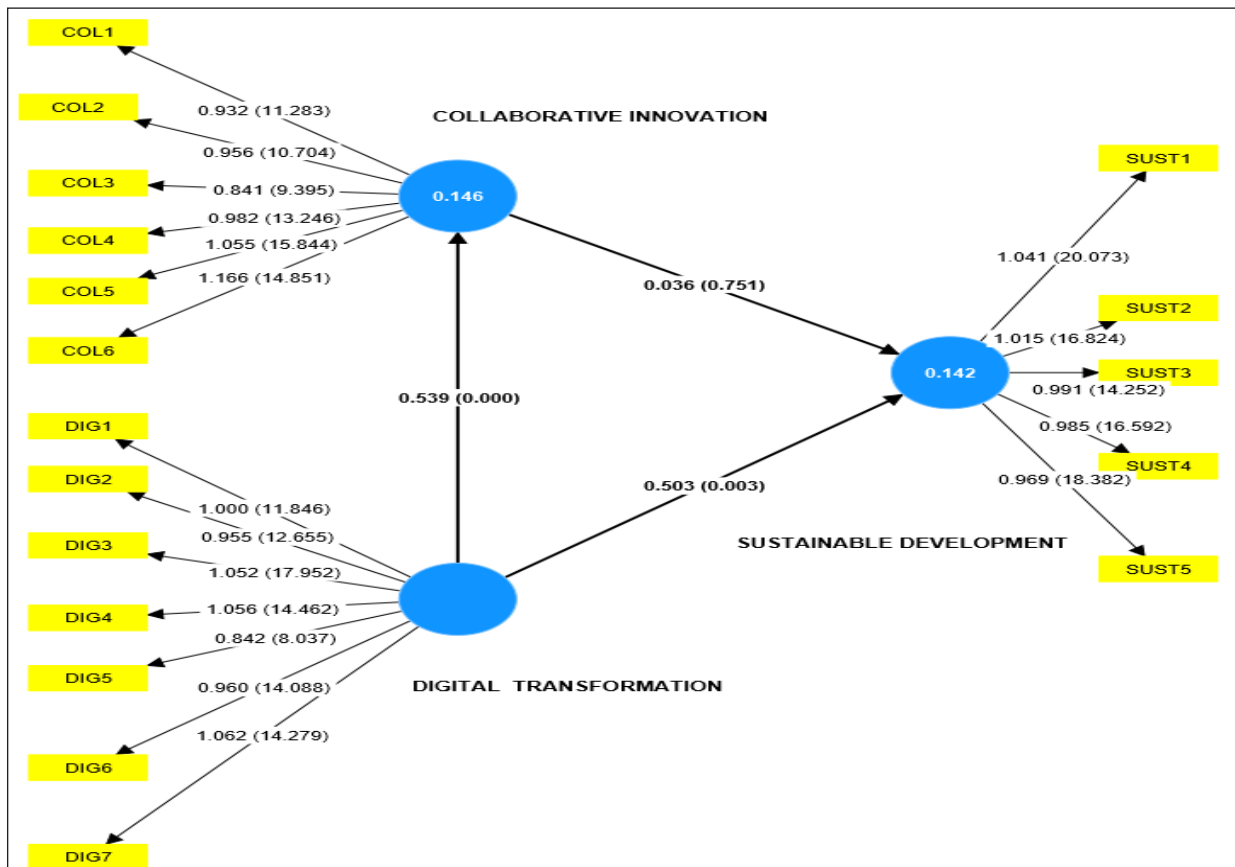


Fig. 3: Three Factor Structural Model

The loading estimates remained stable from the measurement model, showcasing the consistency of parameters across the measured items, the results further reinforce and support the validity of the measurement model (Hair et al., 2010).

Thus, the model proposes that sustainable entrepreneurship

is predicted by the digital transformation, with the mediation of collaborative innovation. To ascertain the significance and relevance of the relationships in the structural model, t-values were compared to the critical t-values for a significance level of 0.05.

Model Fit with The Bayesian Information Criterion

The Bayesian Information Criterion (BIC) is a statistical criterion used for model selection. The BIC is calculated using the likelihood function and a penalty term based on the number of parameters in the model as shown in Table 7a. The model with the lower BIC is considered a better fit. A BIC less than 0 favours the hypothesised model (Bauldry, 2015).

Table 7a: The Bayesian Information Criterion

Construct	BIC (Bayesian Information Criterion)
Collaborative Innovation	-7.134
Sustainable Development	-2.081

Source: Author’s estimation.

Collaborative Innovation BIC: -7.134

A more negative BIC indicates a better fit. In the context of Collaborative Innovation, the BIC value of -7.134 suggests

that the model with Collaborative Innovation is favoured over alternative models for explaining the observed data. This value reflects the trade-off between model fit and complexity, with a lower BIC indicating a more parsimonious and effective model.

Sustainable Development BIC: -2.081

The BIC value of -2.081 for Sustainable Development suggests that the model including Sustainable Development is preferred over alternative models. This lower BIC indicates that the inclusion of Sustainable Development in the model provides a better fit to the data while considering the complexity of the model.

HYPOTHESIS TESTING OF THE STUDY

To ascertain the significance and relevance of the relationships in the structural model, t-values are compared to the critical t-values for a significance level of 0.05 (given in Table 8).

Table 8: Path Coefficients Details of Structural Model

Path Coefficients	Hypothesis	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P-Values
Digital Transformation -> Sustainable Development	H1	0.503	0.512	0.168	2.986	0.003
Digital Transformation -> Collaborative Innovation	H2	0.539	0.566	0.125	4.325	000
Collaborative Innovation -> Sustainable Development	H3	0.036	0.036	0.114	0.317	0.751
Digital Transformation -> Collaborative Innovation -> Sustainable Development	H4	0.019	0.021	0.067	0.290	0.772

Source: Author’s estimation.

H1: There is a positive and significant relationship between digital transformation and sustainable entrepreneurship.

The path coefficient of 0.503 indicates a positive relationship between Digital Transformation and Sustainable Development. The t-value (|O/STDEV|) of 2.986 is statistically significant (p-value = 0.003), suggesting that Digital Transformation has a significant impact on Sustainable Development. In other words, digital transformation is associated with an increase in sustainable entrepreneurship.

H2: There is a positive and significant relationship between digital transformation and collaborative innovation.

The path coefficient of 0.019 represents the relationship from Digital Transformation through Collaborative Innovation to Sustainable Development. The t-value (|O/STDEV|) of 0.29 is not statistically significant (p-value = 0.772), indicating

that the observed relationship may not be significant. In this case, the p-value is greater than the common significance level, so we do not have sufficient evidence to consider a statistically significant relationship between digital transformation and collaborative innovation. However, the data does not provide sufficient evidence to support a significant relationship between digital transformation and collaborative innovation (H2). Therefore, we fail to support H2.

H3: Collaborative innovation has a positive and significant impact on sustainable entrepreneurship.

The path coefficient of 0.036 indicates a positive relationship between Collaborative Innovation and Sustainable Development. However, the t-value (|O/STDEV|) of 0.317 is not statistically significant (p-value = 0.751), suggesting that the observed relationship may be due to random chance. Therefore, we nullify H2.

Mediating Effect

The mediation propositions evaluate the significant associations between the independent-dependent variable, independent - mediating variable, and mediating - dependent variable by using Baron and Kenny’s (1986) technique.

H4: Collaborative Innovation mediates the relationship between Digital Transformation and Sustainable Entrepreneurship.

The path coefficient of 0.019 represents the relationship from Digital Transformation through Collaborative Innovation to Sustainable Development. The t-value ($|O/STDEV|$) of 0.29 is not statistically significant ($p\text{-value} = 0.772$), indicating that the observed relationship may not be significant. Therefore, Collaborative Innovation mediates the relationship between Digital Transformation and Sustainable Entrepreneurship ineffectively. Further analysis and additional data may be necessary to determine the strength and significance of this mediating role.

Hypotheses 1 and 2 are supported by the data, suggesting that Digital Transformation significantly influences both Collaborative Innovation and Sustainable Development. However, Hypotheses 3 and 4 do not show statistically significant relationships based on the provided t-values and p-values.

R² and F²

The R-squared values provide understandings into the proportion of variance explained by the models for “Collaborative Innovation” and “Sustainable Development.” The F-Square values indicate the overall model fit for specific relationships. “Digital Transformation” is a significant predictor for both “Collaborative Innovation” and “Sustainable Development,” while “Collaborative Innovation” does not significantly explain the variance in “Sustainable Development.”

The value of R² is employed to evaluate the portion of variability in the dependent variable that can be accounted for by one or multiple independent variables (Fassott et al., 2016). In this study, the value of R² is found to be acceptable based on the study’s requirements. Falk and Miller (1992) suggest that a value above 0.10 is acceptable for R².

Table 9: R-Square and R-Square Adjusted

Constructs	R-Square	R-Square Adjusted
Collaborative Innovation	0.146	0.137
Sustainable Development	0.142	0.123

Source: Author’s estimation.

For “Collaborative Innovation,” the R-squared value is 0.146, while the adjusted R-squared is 0.137. These values suggest that the model explaining “Collaborative Innovation” accounts for about 14.6% of the variance in this variable, and the adjusted value, which accounts for the number of predictors, is 13.7% (given Table 9 and Fig. 3).

For “Sustainable Development,” the R-squared value is 0.142, and the adjusted R-squared is 0.123. Similarly, this indicates that the model explaining “Sustainable Development” explains approximately 14.2% of the variance, and the adjusted value is 12.3% (given Table 9 and Fig. 3). A higher R-squared value indicates a better fit of the model to the data.

F-Square

Table 10: F-Square Effect Size

Constructs	F-Square
Collaborative Innovation -> Sustainable Development	0.001
Digital Transformation -> Collaborative Innovation	0.171
Digital Transformation -> Sustainable Development	0.129

Source: Author’s estimation.

The F-square values represent the effect size of each predictor in explaining the variance in the respective outcome variable, as depicted in Table 10.

“Digital Transformation -> Collaborative Innovation” has an F-Square value of 0.171. This suggests that there is a statistically significant relationship between “Digital Transformation” and “Collaborative Innovation.” The model explains a notable proportion of the variance in “Collaborative Innovation.”

“Digital Transformation -> Sustainable Development” has an F-Square value of 0.129. This value indicates a statistically significant relationship between “Digital Transformation” and “Sustainable Development.” The model explains a significant portion of the variance in “Sustainable Development” based on “Digital Transformation.”

The F-square of 0.001 indicates a very small effect size for Collaborative Innovation in explaining the variance in Sustainable Development. This suggests that Collaborative Innovation, as a predictor, has a minimal impact on the variability observed in Sustainable Development.

IMPLICATION OF THE STUDY

Theoretical Implications

Digital Transformation and Sustainable Development (H1): The positive path coefficient (0.503) and the statistically

significant t-value (2.986, p-value = 0.003) suggest that Digital Transformation has a direct and meaningful impact on Sustainable Development. The theoretical implication involves reinforcing the understanding that strategic digital initiatives play a crucial role in fostering sustainable outcomes.

Digital Transformation and Collaborative Innovation (H2): The substantial path coefficient (0.539) and high t-value (4.325, p-value = 0.000) signify a strong positive association between Digital Transformation and Collaborative Innovation. Theoretical implications may involve exploring the mechanisms through which digital advancements stimulate collaborative practices.

Collaborative Innovation and Sustainable Development (H3): While the R-square (0.146) suggests a moderate explanatory power, the path coefficient (0.036) is statistically significant (t-value = 0.317, p-value = 0.751). Theoretical implications include further investigating the specific collaborative processes that contribute to sustainable development.

Digital Transformation → Collaborative Innovation → Sustainable Development (H4): The non-significant indirect effect (path coefficient = 0.019, t-value = 0.290, p-value = 0.772) highlights a theoretical gap in the assumed mediation. Theoretical discussions may explore the complexities in the relationship between digital transformation, collaborative innovation, and sustainable development.

Practical Implications

Organisations can leverage the proven positive impact of Digital Transformation on Sustainable Development for practical sustainability initiatives. This involves integrating digital technologies strategically to achieve sustainable goals, such as resource efficiency and environmental conservation.

Acknowledging the strong relationship between Digital Transformation and Collaborative Innovation, practical implications include fostering collaborative cultures within organisations. This can be achieved through digital platforms, tools, and initiatives that encourage knowledge sharing and cross-functional collaboration. While Collaborative Innovation may have a moderate impact on Sustainable Development, organisations can still benefit practically by promoting collaborative practices. Initiatives may include establishing interdisciplinary teams and platforms for collaborative ideation to enhance sustainability efforts.

Economic Implications

The positive association between Digital Transformation and Sustainable Development implies potential economic

benefits. Organisations aligning digital strategies with sustainability goals may experience improved economic performance through cost savings, enhanced market reputation, and increased competitiveness.

Managerial Implications

Managers should recognise the direct positive impact of Digital Transformation on Sustainable Development and strategically align digital initiatives with sustainability objectives. Managerial efforts can focus on developing comprehensive strategies that leverage digital capabilities to achieve measurable sustainable outcomes. Given the strong link between Digital Transformation and Collaborative Innovation, managerial implications involve creating environments that support collaborative practices. This may require investment in training programs, digital infrastructure, and leadership initiatives to foster a collaborative organisational culture.

Entrepreneurial Implications

Entrepreneurs can explore opportunities in developing innovative solutions that leverage digital technologies for sustainable outcomes. Start-ups may focus on creating products or services that align with the positive impact of Digital Transformation on Sustainable Development. Recognising the significance of Digital Transformation in stimulating Collaborative Innovation, entrepreneurial ventures can explore opportunities in providing digital tools or platforms that facilitate collaboration among organisations, potentially contributing to sustainable development.

Social Implications

Social implications involve recognising the positive impact of Digital Transformation on Sustainable Development, highlighting the potential societal benefits. Digital initiatives aligned with sustainability goals can contribute to positive social change, including job creation and improved community well-being. The emphasis on Collaborative Innovation suggests social benefits arising from collaborative practices within organisations. Socially, this can contribute to knowledge-sharing, skill development, and community building.

RESEARCH LIMITATIONS AND FUTURE RESEARCH AVENUES

The study has inherent limitations that warrant consideration in interpreting its findings. The cross-sectional design poses

challenges in establishing causal relationships, underscoring the need for longitudinal studies to capture the dynamic interplay among digital transformation, collaborative innovation, and sustainable development over time. Generalisability is constrained by the specific industries and organisational contexts in the sample, cautioning against broad extrapolations. Potential common method bias, arising from reliance on self-reported data, underscores the importance of employing diverse data collection methods. The theoretical model may not comprehensively encompass all relevant factors, and ongoing technological and organisational developments could impact its applicability. Despite these limitations, the study offers valuable understandings. Future research avenues should involve longitudinal studies to explore temporal dynamics and diversify across industries for enhanced generalisability. Exploring specific collaborative mechanisms, platforms, and considering contextual factors like leadership styles and organisational culture could deepen understanding. Introducing variables interacting with digital transformation and collaborative innovation, along with cross-cultural studies, can provide richer understandings. These future research directions aim to advance comprehension and offer valuable insights for academic and practical applications in digital transformation, collaborative innovation, and sustainable development.

CONCLUSION

This study establishes a significant positive relationship between digital transformation and sustainable performance (H1), highlighting the important role of strategic digital initiatives in promoting sustainability. However, collaborative innovation does not have a significant effect on sustainability, testing the hypothesised mediating role of the relationship between digital transformation and sustainability (H3 and H4). Theoretical implications emphasize the importance of deepening collaborative strategies that contribute to sustainable development, while economic, business, operational, and social implications emphasise the integration of digital technologies and collaborative practices in strategic emphasis for sustainable effectiveness, improved economic performance and positive social change. These acumens help sharpen sustainable digital business practices and guide future research and practical applications.

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UNVEILING EFFICIENCY: A COMPREHENSIVE ANALYSIS OF INDIAN PSBs THROUGH DATA ENVELOPMENT ANALYSIS (DEA) AND SCALING TECHNIQUES

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Abstract *In today's highly competitive and complex banking industry, the long-term viability of banks depends on their ability to operate efficiently. This has become of utmost significance in light of globalisation and liberalisation. The importance of efficiency has become even more evident since India began its financial liberalisation process in 1991, followed by a greater focus on globalisation in the 2000s, the global financial crisis of 2008, and the ongoing effects of the COVID-19 pandemic. These events have highlighted the pressing requirement for efficiency. This article evaluates the effectiveness of public sector banks (PSBs) by utilising scaling techniques and DEA assumptions. The assessment is by designated efficiency indicators and takes into account the banks' size. The findings suggest that the interest income efficiencies of the majority of banks are typically near optimal levels. Nevertheless, a considerable proportion of banks demonstrate subpar efficiencies in generating non-interest income, failing to meet satisfactory benchmarks. The difference between the efficiencies of interest and non-interest income has a significant impact on the overall efficiency of banks, which brings it closer to acceptable levels. The panel regression analysis reveals that factors such as cost to income, spread, CASA, income per branch, NPAs, and bank size significantly influence the efficiency of banks.*

Keywords: Sustainability, PSBs, Efficiency, Interest Income, Non-Interest Income, Cost to Income, Spread, NPAs

JEL Classification: D61, G21, G34.

INTRODUCTION

Banks, like the heart of a functioning organism, are dynamic engines fuelling the growth of a burgeoning economy. Their critical significance extends beyond simple financial management; they are the architectures of economic advancement. Banks support businesses, foster innovation, and catalyse investment by providing a strong financial infrastructure. A bank's operational efficiency, a key indicator of their strength, is analogous to the accuracy of a well-choreographed dance, facilitating smooth financial operations. Recent studies, such as the IMF (Gobat, 2017) and the World Bank's Global Financial Inclusion Database, highlight the critical role of banks in economic growth, emphasising the necessity for nimble and responsive

financial institutions to meet the ever-changing demands of a modernising world. Increasing technology and competition highlight the need for a highly efficient banking sector. It underlines the significance of banks' relevant monitoring and performance assessment since this might undermine their overall efficiency and profitability. Globally, performing assets in the banking business are continuously rising, and more considerable assets influence loan prices and interest rates, influencing shareholders, investors' thinking, creditors, and depositors (Dsouza et al., 2022; Hassan et al., 2022). The high interest rate directly impacts the borrowers' decision to take a loan and repay, resulting in the poor recovery of funds and lower bank revenue. Bank's efficiency is critical here, as those with higher efficiency will have a competitive advantage and can create more income by delivering better products and services at a lower cost with additional features

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(Rabbani et al., 2022; Sun et al., 2020; Singh & Singh, 2015). Banks are challenged to perform efficiently in the highly competitive financial services market. Banks with better efficiency are more likely to survive than banks with lower efficiency. Regarding the supply of credit granted to enterprises in industries that rely on external funding, bank efficiency is recognised as a critical issue (Diallo, 2018). High efficiencies please all stakeholders, whereas low efficiencies may have profound negative implications. This requires bank owners, customers, regulatory authorities, and investors to monitor bank efficiency.

In India, private sector banks were founded to supplement the functions of public sector banks (PSBs), in which the government holds the majority of stakes, intending to improve economic service. There is a consensus among academic literature that private banks consistently outperform their public counterparts across various parameters. For instance, Tamatam et al. (2019) assessed both sectors from 2008 to 2017. They inferred that private banks rank higher in aspects like the banking system, profitability, capital adequacy, management efficiency, income, and liquidity. To emphasise the link between profitability and efficiency, Goel and Rekhi (2013) have shown that PSBs are less profitable than private banks because of operational inefficiency. Hence, studying PSBs' efficiency has become increasingly essential as these banks continue dominating market share, economic effect, number of branches, public perception, and total contribution to the financial system. The current literature needs to include in-depth studies on the efficiency and its determinants of public sector banks in India. This paper, in the Indian context, aims to analyse the technical efficiency of the banks and rank them based on efficiency. Identify the most probable factors influencing the operational efficiency of the public sector banks from 2015 to 2023.

LITERATURE REVIEW

Pradhan et al. (2015) conducted a study to quantify the operational efficiency of public sector banks in India. They discovered that Indian banks are underperforming due to regulatory changes, financial consolidations, competition, and technological advancements. Gulati and Kumar (2017) used a two-stage DEA network separating intermediation and operating efficiency. They used the bootstrapped truncated regression approach to identify the factors influencing both efficiencies. They discovered a difference in the efficiency of PSBs and private banks, with the former being more efficient than the latter at the intermediate and operating stages. More importantly, the regression determined that variations in intermediation efficiency can be associated with variations in bank size, cost of intermediation, etc. In contrast, variations in operating efficiency can be related to profitability and

various sources of income generation for banks. Rezvanian et al. (2008) studied the banks in India from 1998–2003 to observe the influence of ownership on the efficiency of the banks. The study opines that the efficiency of some large PSBs was lesser than that of small-sized banks, and their efficiencies can be improved by scaling up their operations. Recently, research studies have been divided into diverse pathways, resulting in some fascinating DEA applications and advanced methodologies. Raina and Sharma (2013) stated that the significant inefficiency observed among PSBs between 2006 and 2011 was related to the regulatory framework rather than managers' underutilisation of financial resources. Sanjeev (2007) conducted research from 1997 to 2001 and concluded that the size of a bank has no meaningful effect on its efficiency. Kumar and Gulati (2008) conducted their study using 2015 panel data from a selection of banks, producing a matrix of efficiency scores and ROA to examine how it relates to profitability. Kumar (2013) investigated the cost efficiencies of PSBs between 1993 and 2008. He observed that the technical and allocative efficiencies were trending in different directions, with the latter trending downward. Sing and Singh (2015) attempted to analyse the efficiency of public sector banks using the scaling technique, as recommended efficiency metrics of banks, while keeping the bank's size in mind. During the analysis, it was discovered that just a few banks are near high efficiency, with the others falling somewhere near satisfactory level. Bhatia and Mahendru (2015) examined the technological efficiency of reformatory and post-reformatory decades. They discovered a statistically significant difference and concluded that the latter decade outperformed the former, attributing the inefficiency to solely technical and scale inefficiencies. It should be noted that the literature has primarily focused on the efficiency level of Indian public-sector banking by employing various parameters. In contrast, no such extensive work has been done on operational efficiency parameters, except a small amount of work involving one or two parameters (efficiency and profit) of the banking sector. This paper aims to examine the efficiency of public sector banks in various operating areas and to identify the factors influencing them.

METHODOLOGY

Data and Sample

The study is based on secondary data sources and quantitative methods. Data is extracted from the financial annual reports of the selected nationalised public sector banks (PSBs), their official websites, the ACE knowledge portal, and two web-based databases, i.e., www.investing.com and www.moneycontrol.com. We have selected all 12 nationalised

public sector banks (PSBs) in India for the study. Since there was a shift in the government of India from UPA to NDA in 2014, we have taken a sample period from March 2015 to March 2023.

Following the study of Singh and Singh (2015), we employed an average mean of each public sector bank’s numbers over

the previous nine years. Furthermore, each bank has been graded on a scale of poor, satisfactory, better, and excellent. Bank efficiency is measured using variables such as the cost of funds, spread as a proportion of assets, net NPA to net advance, cost to income, and ROAs. These factors are optimal for analysing the bank’s efficiency (Table 1).

Table 1: Sample Description

Determinants of Technical Efficiency of Indian PSBs (Used in DEA)	
Total Interest Income	(Interest/Discount on advances/Bills + Income from investments + Interest on Balance with RBI + Other Interest)
Total Non-interest Income	Total Income – Total Interest Income
Total Operating Expenses (OE)	Interest Expended + Employee costs + Depreciation + operating expenses (excluding employee costs and Depreciation)
Interest Expended (IE)	The cost of debt interest for a specific period
No of Employees and Branch	The number of active members working for a bank and active operating branches for a specific period
Non-interest Expenses	Total Operating Expenses – Interest Expended
Factors Influencing the Efficiency of Indian PSBs (Used in Panel Regression)	
Cost of Fund (COF) (Singh & Singh, 2015)	(Interest paid on borrowings + interest paid on deposits)/(average of current and previous year’s borrowings and deposits)
Cost to income (CI)	It is the percentage of total cost to total revenue.
Spread as a percentage of Total Assets (SPRD) (Singh & Singh, 2015) Spread = Return on Fund – Cost of Fund	The gap in percentage terms between the interest rate on a bank loan and the lender’s cost of funds. In contrast to the net interest margin.
Net Profit per Employee	This depicts the net profit earned per employee. It is calculated by dividing the bank’s earnings after tax by the total number of workers.
Net Profit per Branch	This depicts the net profit earned per branch. It is calculated by dividing the bank’s earnings after tax by the total number of branches.
Bank Size (Vidyarthi, 2020; Lensink et al., 2018)	The firm’s size plays a role in sustainability and efficiency as larger banks benefit from economies of scope. The natural logarithm of total assets measures a bank’s size.
CASA: The CASA ratio, which stands for current account and savings accounts, reflects the proportion of these accounts to total deposits. A higher CASA ratio suggests the availability of low-cost financing, which enhances bank operational efficiency.	
Net Non-Performing Assets (NPAs): The standard asset quality metric is net NPAs as a proportion of net advances (Chawla & Rani, 2021). NPAs have been observed to have a negative impact on Indian banks’ financial performance (Chaudhary & Kumar, 2023; Sahoo & Majhi, 2022), causing banks to actively control their NPAs and operational expenses to boost profitability (Das & Uppal, 2021).	

Abbreviations

PNB = Punjab National Bank
 BOM = Bank of Maharashtra
 UBI = Union Bank of India
 BOB = Bank of Baroda
 BOI = Bank of India
 CB = Canara Bank
 NPA = Non-Performing Assets
 COF = Cost of Fund
 SPRD = Spread

CBI = Central Bank of India
 UCO = UCO Bank
 IOB = Indian Overseas Bank
 In B = Indian Bank
 P & SB = Punjab and Sindh Bank
 SBI = State Bank of India
 CI = Cost to Income
 ROA = Return on Assets

EMPIRICAL SPECIFICATIONS

Data Envelopment Analysis (DEA)

Efficiency estimates for a set of Decision-Making Units (DMUs) can be generated through various parametric and non-parametric methods found in the efficiency literature. Data Envelopment Analysis (DEA) falls into the non-parametric category, creating a frontier encompassing all efficient units with scores equal to 1. In contrast, relatively inefficient DMUs receive scores below 1. This study and numerous others in the efficiency field opt for DEA over alternative methods for several reasons. DEA allows the selection of inputs and outputs without assigning relative importance to each, and it does not require assumptions about the distribution of efficiencies (Chaluvadi et al., 2018). The two traditional models introduced by Charnes et al. (1978) (CCR) and Banker et al. (1984) (BCC) are built on constant and variable return-to-scale assumptions, respectively. The Data Envelopment Analysis (DEA) model can be used to calculate the efficiencies of Decision-Making Units (DMUs) in any industry, including banking, agriculture, healthcare, manufacturing, hotels/restaurants, etc., by taking into account the respective DMUs, which include banks, agricultural firms, hospitals, manufacturing plants, educational institutions, government institutions, and even individuals. To produce achievable targets, DEA can identify benchmark DMUs for each inefficient DMU (Tamatam et al., 2019). For the computation of the technical efficiency of banks with output bundle y^0 from the input bundle x^0 , the output-oriented variable returns to scale (VRS) DEA model is specified as:

$$\tau_y(x^0, y^0) = \frac{1}{\varphi^*}$$

Where $\varphi^* = \max \varphi$

subject to

$$\sum_{j=1}^N \lambda_j y^j \geq \varphi y^0;$$

$$\sum_{j=1}^N \lambda_j x^j \leq x^0;$$

Where $\sum_{j=1}^N \lambda_j = 1$, and $\lambda_j \geq 0$ (non-negative), ($j = 1 \dots \dots \dots N$), φ is unrestricted, x^0 is the input used by the bank under consideration, and y^0 is the output of the bank under consideration $\frac{1}{\varphi}$ is the technical efficiency, λ is the weight, and y is the output (income) of the j^{th} banks.

SET 1 - IIE	SET 2 - NIIE
Total Interest Income (Output)	Total Non-interest Income (Output)
Total Operating expenses (Input 1)	Total Operating expenses (Input 1)
Interest Expended (Input 2)	Interest Expended (Input 2)
Number of Employees (Input 3)	Number of Employees (Input 3)
Number of Branches (Input 4)	Number of Branches (Input 4)
Total Non-interest Expenses (Input 5)	Total Non-interest Expenses (Input 5)

Panel Data Regression

The Lagrange multiplier test indicates that pooled ordinary least square (POLS) is inappropriate for the data. Then, the Hausman test is used to decide the appropriate model for the analysis. The results suggested that the Random Effect Model (REM) is appropriate for both Interest and Non-interest income efficiency models. Thus, our basic model would be:

$$y_{it} = \beta_{1i} + \beta_2 X_{it} + \gamma X_{it} + u_{it}$$

Instead of considering β_{1i} to be fixed, we consider it a random variable with a mean value of β_1 , and an individual company's intercept value may be stated as follows:

$$\beta_{1i} = \beta_1 + \varepsilon_i \quad i = 1, 2, \dots \dots N$$

Where ε_i is the random error term with a mean zero, and σ_ε^2 is variance. We mean that the 12 public sector banks in our sample are drawn from a much larger universe of such institutions and have a standard mean value for the intercept (mean = β_1), with individual differences in intercept values reflected in the error term ε_i .

$$y_{it} = \beta_1 + \beta_2 X_{it} + \gamma X_{it} + \varepsilon_i + u_{it}$$

$$y_{it} = \beta_1 + \beta_2 X_{it} + \gamma X_{it} + w_{it} \quad \text{and} \quad w_{it} = \varepsilon_i + u_{it}$$

Where y_{it} is the dependent variables' vector (Interest-income Efficiency and Non-interest income Efficiency), β_2 and γ are coefficients, and X_{it} is the constitutes of independent and control variables (cost of fund, cost to income, bank size, CASA ratio, spread, income per branch, income per employee, and NPA). W_{it} is the composite error term that consists of two components, i.e., ε_i = cross-section or individual specific error component, and u_{it} = combined error component of time series and cross-section.

DATA ANALYSIS, RESULTS AND FINDINGS

Table 2 represents the descriptive statistics of selected variables influencing the efficiencies and efficiency level of the Indian PSBs. The finding reveals that most banks' interest income efficiencies are generally close to high efficiency (mean = 92.6%). However, a significant number of banks exhibit low non-interest income efficiencies below satisfactory levels (mean = 77.9%). This imbalance between interest income and non-interest income efficiencies significantly impacts the overall efficiency of banks, bringing it closer to just satisfactory levels (mean = 85.2%). The natural logarithm of total assets yields 13.24 as the mean, 10.064 for the lowest, and 15.52 as the maximum value of bank size. When converted into absolute values, the mean, lowest, and maximum values are Rs. 979914.3 crore, Rs.

23484.1 crore, and Rs. 5516978.5 crore, respectively. The average CASA ratio (37.22%) remains low compared to private banks. This might be one of the causes of Indian public sector banks' poor performance. From a banking standpoint, loan performance is often inadequate, with the average non-performing asset (NPA) standing at 5.1%, ranging from 0.25% to 15.33%. The cost of funds for all the PSBs hovers around 5 percent to 6.75 percent, with certain variations among the individual banks. The mean income value per employee and branch is negative because most Indian PSBs were at a loss during the first term of the NDA government (2014 – 2019). The turnaround came post-COVID-19 as the banks performed much better than in the pre-COVID-19 era. The spread-to-assets ratio is comparatively better than other efficiency indicators, with a mean value above 2.2%. The cost-to-income ratio ranges from 22.03% to 82.7%, considered higher for the Indian PSBs.

Table 2: Descriptive Statistics

Variables	Count	Mean	S.D.	Min	Max	Sum
IIE	108	0.92657	0.06851	0.59	1	100.07
NIIE	108	0.7788	0.16446	0.41	1	84.11
Average Efficiency	108	0.85269	0.09589	0.625	1	92.09
CASA	108	37.32	7.43743	21.53	57.85	4030.75
Bank Size	108	13.2486	1.06862	10.064	15.52	1430.84
NPA	108	5.10009	3.12599	0.25	15.33	550.81
Cost of Funds	108	5.17065	1.0025	3.4125	7.8106	558.430
Income/Employee	108	-54537.2	1035492	-3704698	2129775	-5890014
Income/Branch	108	-468076	8377850	-2611286	22420198	-50552219
Spread	108	2.205	0.28716	1.44	2.89	238.14
Cost to Income	108	43.4636	10.6062	22.03	82.77	4694.07
Efficiency Level of Indian PSBs (2015 -2023)						
Efficiency Score	IIE Freq.	NIIE Freq.	Average Efficiency Freq.			
0.00 - 0.50	0	7	0			
0.51 - 0.60	1	10	0			
0.61 - 0.70	0	18	7			
0.71 - 0.80	2	26	20			
0.81 - 0.90	31	20	44			
0.91 - 1.00	74	27	32			

Note: IIE = Interest Income Efficiency; NIIE = Non-interest Income Efficiency.

Table 3 displays the efficiency of the Indian PSBs based on the DEA model (output-oriented variable returns to scale approach). As per the results, the Punjab & Sindh Bank, the State Bank of India, and the Canara Bank are the top 3 most

efficient Indian PSBs. On the other hand, the Central Bank of India, the Indian Overseas Bank, and the UCO Bank are the least efficient PSBs in India.

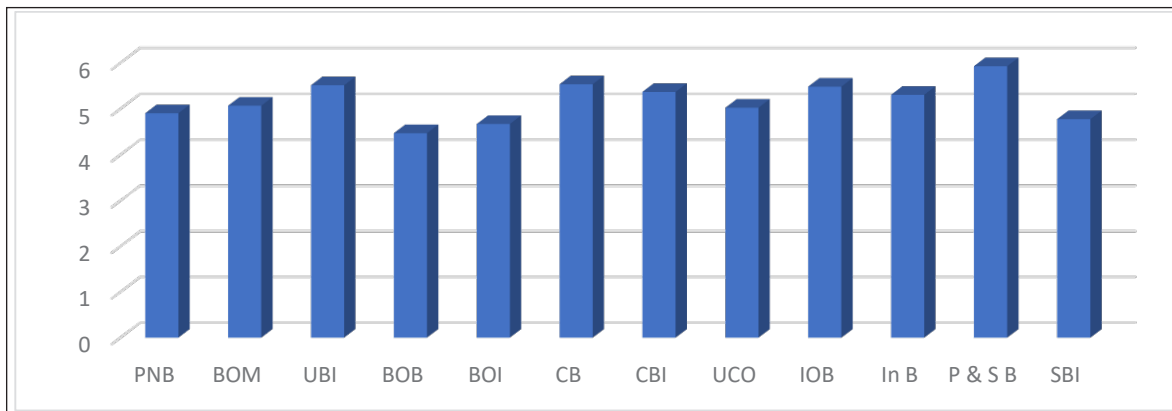
Table 3: Efficiency Scores Based on DEA Model (Output-Oriented VRS)

Sr. No.	Banks	IIE	NIE	Overall Efficiency	Ranks
1	PNB	0.95	0.76	0.85	5
2	BOM	0.93	0.77	0.85	7
3	UBI	0.95	0.77	0.86	4
4	BOB	0.97	0.71	0.84	8
5	BOI	0.91	0.72	0.82	9
6	CB	0.93	0.86	0.90	3
7	CBI	0.86	0.51	0.68	12
8	UCO	0.87	0.76	0.81	10
9	IOB	0.82	0.80	0.81	11
10	In B	0.96	0.74	0.85	6
11	P & S B	0.99	0.97	0.98	1
12	SBI	0.99	0.97	0.98	2

Scaling Technique for Efficiency Analysis

Fig. 1 shows that the cost of funds for all PSBs ranges between 5% and 6.75%, with some variance across banks. This cost has been higher in the cases of Union Bank of India, Canara Bank, and Punjab & Sindh Bank. On the contrary, the Bank of Baroda has the advantage of the lowest cost of funds (4.47%) (consistent with the finding of Singh

& Singh, 2015), while the remaining public sector banks have fared satisfactorily in the cost of funds. It is well known that the cost of funds and spread have an inverse connection, influencing the bank’s total efficiency. To maintain the bank’s efficiency, it appears that a corresponding level of cost of funds and spread is necessary. Individual banks must optimise their financing costs and attain efficiency in the globalised environment.

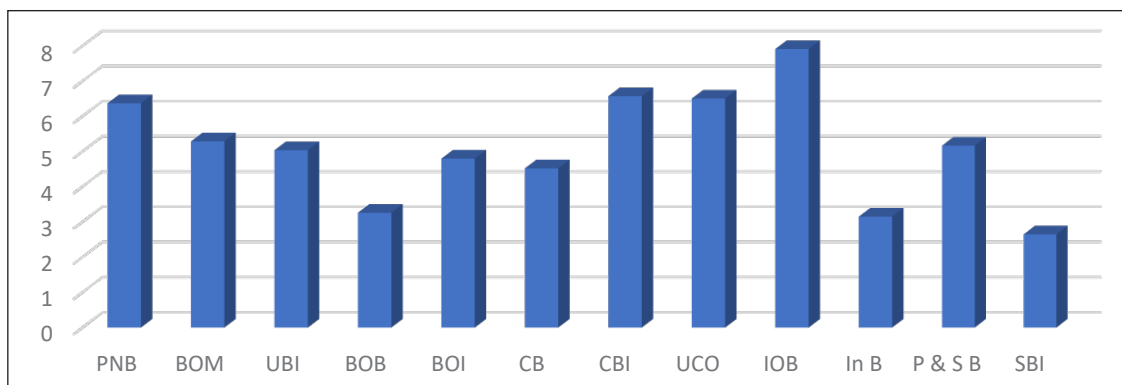


Rank	Poor	Satisfactory	Better	Excellent
Scale	> 5.51	4.1 – 5.5	2.1 – 4.0	0 – 2.0
	UBI, CB, P & SB,	PNB, BOM, BOB, BOI, CBI, UCO, IOB, In B, SBI		

Fig. 1: Cost of Funds (%)

Another crucial indicator for measuring a bank’s efficiency is its amount of NPAs. NPAs have several effects on a bank’s performance. More significantly, it impacts a bank’s earnings since banks do not collect interest on these assets; second, banks must make provision for such assets from current year profits, and bank liquidity is also adversely affected.

Fig. 2 shows that all the Indian PSBs performed miserably in this operating efficiency parameter. All were ranked in the poor category except SBI, whose NPA (%) is below 3%. IOB, CBI, UCO, and PNB are the worst-hit banks on this parameter.

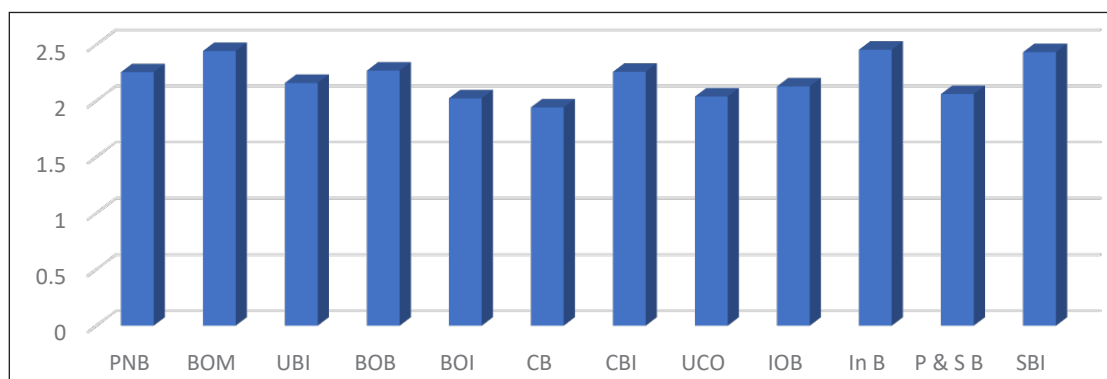


Rank	Poor	Satisfactory	Better	Excellent
Scale	> 3.0	1.5 – 2.99	1.01 – 1.49	0 – 1.0
	PNB, BOM, UBI, BOB, BOI, CB, CBI, UCO, IOB, In B, P & SB, SBI			

Fig. 2: NPA (%)

Fig. 3 shows that the spread-to-assets ratio is much better than other criteria, indicating that the bank is efficient and profitable. The spread, on the other hand, is the difference between the assets' cost and return. Individual banks can choose between spreads ranging from 1.44% to 2.89%. According to the rating of PSU banks, three banks, namely Bank of India, Canara Bank, and UCO Bank, performed

inefficiently (less than 2% spread as a proportion of assets). The Indian Bank, on the other hand, had the highest (2.5%), and the Central Bank had the lowest (1.9%) spread on assets. The remaining banks have fared better (between 2 and 3 percent). The data also shows that spread is an effective indication of operational efficiency.



Rank	Poor	Satisfactory	Better	Excellent
Scale	0.0 – 1.0	1.1 – 2.0	2.1 – 3.0	> 3.1
		BOI, CB, UCO	PNB, BOM, UBI, BOB, CBI, IOB, In B, P & SB, SBI	

Fig. 3: Spread (%)

Fig. 4 displays the cost-to-income ratio for the Indian PSBs. It is assumed that the higher the percentage, lower the profitability. Our finding shows that the Indian Overseas Bank had the highest percentage (more than 50%); conversely, the Canara Bank, Indian Bank, and the Punjab & Sindh Bank enjoyed the lowest (31%-40%) cost-to-income ratio. While a lower cost-to-income ratio is typically preferred, the perfect

ratio will vary based on the bank's business strategy, market circumstances, and strategic objectives. Furthermore, a low ratio may raise concerns about the bank's capacity to invest in vital infrastructure and innovation. As a result, long-term success requires a balanced and deliberate approach to controlling the cost-to-income ratio.

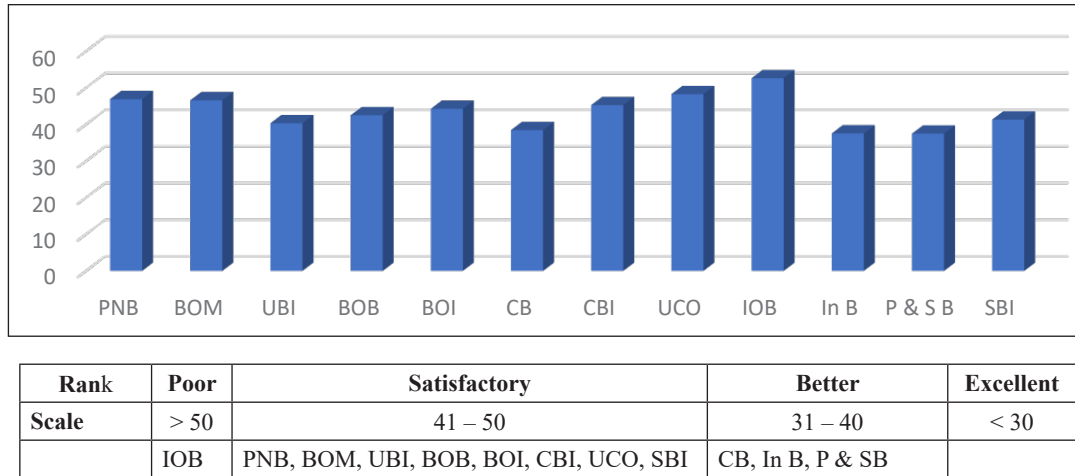


Fig. 4: Cost to Income (%)

The study of Fig. 5 on ROAs (percent) shows how effectively a public sector bank’s assets are leveraged to create profits. If the ratio is higher, total asset returns will be higher, and vice versa. Individual banks’ ROAs range from -0.4375 percent to 0.5875 percent on average. According to the available data, the State Bank of India, Indian Bank, Bank of Maharashtra, and Bank of Baroda performed satisfactorily in terms of return on assets (ROA), ranging from 0.41 to 0.80 percent,

whereas all other PSBs performed below the satisfaction level in terms of ROAs. Therefore, a higher ROA for a bank indicates efficient asset utilisation, improved profitability, effective risk management, and competitive advantage, all of which are critical considerations for operational efficiency and long-term success in the banking business. It is also evident that a bank’s ROAs and cost of funds are inversely related.

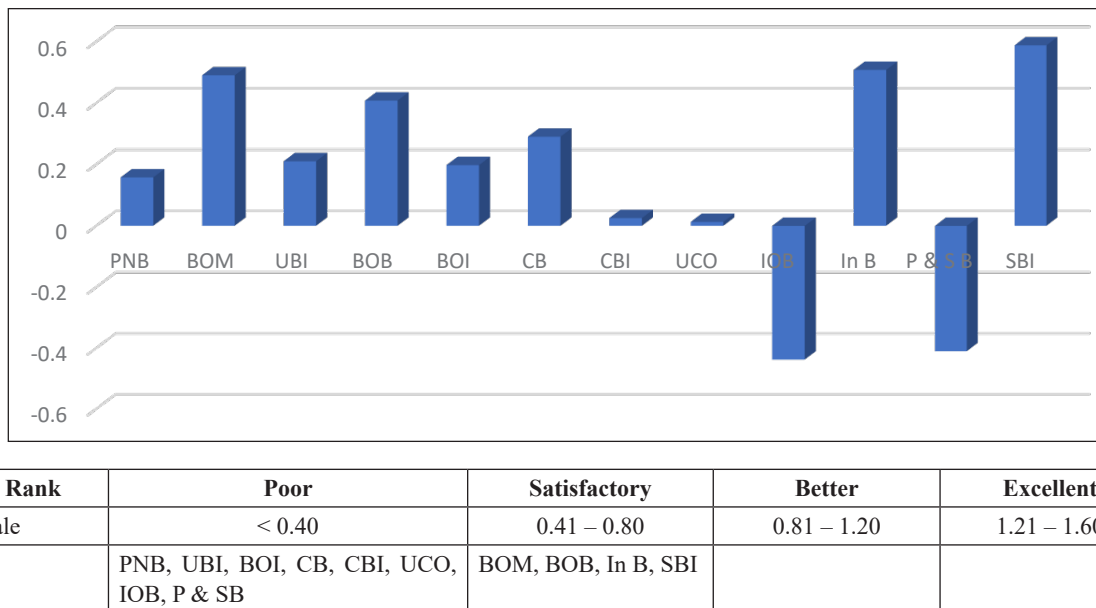


Fig. 5: ROA (%)

From the above analysis, it has been observed that only a few PSBs went above the satisfactory level in 2 out of 5 parameters, and most of the banks either performed at a satisfactory level or below the satisfactory level. We have assigned ranks to the PSBs based on the above scaling technique. The most efficient bank has been assigned rank 1, and the least efficient bank has been given rank 12. Hence,

the lowest average scorer will be the most efficient bank, and the highest scorer will be the least efficient PSB. Table 4 indicates that the State Bank of India, the Indian Bank, and the Bank of Baroda are the top 3 efficient Indian PSBs. In contrast, the Indian Overseas Bank, UCO Bank, and the Central Bank of India are the least efficient PSBs in India.

Table 4: Ranks of PSBs Based on Efficiency Parameters (Scaling Technique)

Banks	NPA	COF	SPRD	CI	ROA	Average Score	Overall Rank
PNB	9	4	6	10	8	7.4	8
BOM	8	6	2	9	3	5.6	4
UBI	6	9	7	4	6	6.4	5
BOB	3	1	4	6	4	3.6	3
BOI	5	2	11	7	7	6.4	6
CB	4	11	12	3	5	7	7
CBI	11	8	5	8	9	8.2	10
UCO	10	5	10	11	10	9.2	11
IOB	12	10	8	12	12	10.8	12
In B	2	7	1	2	2	2.8	2
P & S B	7	12	9	1	11	8	9
SBI	1	3	3	5	1	2.6	1

Selection among POLS, FEM, or REM

Lagrange multiplier tests (Breusch-Pagan) serve as the pivotal tool for model selection among POLS, FEM, or REM analyses (Mahali & Ansari, 2024; Gujarati, 2022). Table 5 displays the outcomes of these Lagrange multiplier tests (Breusch-Pagan). These tests reveal less than 5% probabilities for interest and non-interest income efficiency

models. Consequently, this leads us to reject both models' null hypothesis. The results show that one-way cross-section effects are present in both interest and noninterest income models, but there are no temporal effects. As a result, POLS is deemed inappropriate for both datasets, necessitating a selection between the fixed effect model (FEM) and the random effect model (REM).

Table 5: Lagrange Multiplier Tests for Random Effects

Null hypotheses: POLS is appropriate

Alternative hypotheses: POLS is not appropriate (Go for FEM/REM)

Model 1 Interest Income Efficiency			
	Cross Section	Time	Both
Breusch-Pagan Prob.	53.98792 (0.0000) **	0.035524 (0.8505)	54.02345 (0.0000) **
Honda	7.347647 (0.0000) **	-0.188477 (0.5747)	5.062298 (0.0000) **
King-wu	7.347647 (0.0000) **	-0.188477 (0.5747)	4.624374 (0.0000) **
Model 2 Non-Interest Income Efficiency			
Breusch-Pagan	70.30296 (0.0000) **	0.259835 (0.6102)	70.56280 (0.0000) **
Honda	8.384686 (0.0000) **	0.509740 (0.3051)	6.289309 (0.0000) **
King-wu	8.384686 (0.0000) **	0.509740 (0.3051)	5.828557 (0.0000) **

Note: ** Represents significance at 0.05.

Fixed Effect Model (FEM) or Random Effect Model (REM)

We have two possibilities after rejecting the POLS model: FEM or REM. We employed Hausman's (1978) specification test to select the best model. The test reveals that a probability value of less than 5% resembles the Fixed Effect Model (FEM), while a probability value of more than 5% indicates that the Random Effect Model is acceptable. Thus, Table 6 reveals that the probability value for both models is greater than 5%, meaning that the Random Effect Model is appropriate.

Table 6: Correlated Random Effects – Hausman Test

Test cross-section random effects

Model 1 Interest Income Efficiency			
Test Summary	Chi-sq. Statistics	Chi-sq. d. f.	Prob.
Cross-section random	8.185615	8	0.4156
Model 2 Non-interest Income Efficiency			
Cross-section random	7.004302	8	0.5362

Random Effect Model (REM) Results

Table 7 demonstrates the results for the models discussed in the previous section using Panel EGLS (REM). In Model 1, where the dependent variable is IIE, the cost to income, CASA, and NPA coefficients are significantly negative, implying that these variables adversely impact the Indian

PSBs' efficiency. An increase in these variables might reduce the efficiency of public sector banks (PSBs) in India. It might lead to lower profits, capital loss, and challenges in fulfilling regulatory and stakeholder requirements. Addressing these difficulties frequently necessitates strategic initiatives such as better risk management, reducing costs, and attracting low-cost deposits. On the other hand, the positive coefficient of spread indicates that a rise in spread to total asset ratio will enhance the Indian PSBs efficiency. A positive spread to total assets can improve the efficiency of Indian public sector banks (PSBs) by reflecting their capacity to produce money from interest-earning assets such as loans and investments that surpass the cost of capital. This surplus can help PSBs meet operational expenditures, maintain capital adequacy, and promote overall financial stability.

In Model 2, where the dependent variable is NIIE, the coefficients of CASA, income per branch, spread, NPA, and bank size are significant. The positive coefficients of CASA, income per branch, and bank size indicate that the ability of PSBs in India to earn more non-interest income efficiently increases as the proportion of low-cost CASA deposits, income per branch, and the bank's overall size rises. The negative significant coefficients of spread and NPA suggest that higher spread and higher NPA relate to increased inefficiency in producing non-interest income. This might be seen as a negative indicator of the institution's financial health, showing that improved management of interest-related elements is connected to higher efficiency in producing money from interest rather than non-interest sources.

Table 7: Dependent Variables Interest Income Efficiency (IIE) and Non-Interest Income Efficiency (NIIE); Method: Panel EGLS (Cross-Section Random Effects)

Variable	Model 1 IIE		Model 2 NIIE	
	Coefficient	Prob.	Coefficient	Prob.
Constant	1.068663	0.0000 **	0.420498	0.3705
Cost to Income	-0.004178	0.0446 **	0.000350	0.9388
Cost of Fund	-0.009923	0.4133	-0.002565	0.9252
CASA	-0.001994	0.0885 *	0.009885	0.0104 **
Income/Branch	8.64E-10	0.7726	1.01E-08	0.0950 *
Income/Employee	-3.43E-08	0.1498	-2.82E-08	0.5618
Spread	0.088793	0.0078 **	-0.131676	0.0582 *
NPA	-0.614297	0.0874 *	-0.003505	0.005706 **
Bank Size	0.787834	0.9487	0.420498	0.028632**
R-squared		0.396466	R-squared	0.346732
Adjusted R-Squared		0.347696	Adjusted R-Squared	0.293942
S. E. of regression		0.055333	S. E. of regression	0.100232
F- statistics		8.129239	F- statistics	6.568211
Prob (F-statistics)		0.000000 **	Prob (F-statistics)	0.000001 **
Mean dependent var		0.926574	Mean dependent var	0.172612
S. D. dependent var		0.068511	S. D. dependent var	0.119285
Akaike info criterion		-2.871233	Akaike info criterion	0.994591

Note: ** Represents significance at 0.05, and * represents significance at 0.10 levels.

CONCLUSION

As observed in the literature survey, there is a paucity of detailed efficiency analyses of Indian PSBs utilising the most recent available data. In this light, this work adds to the current literature by conducting a complete and in-depth relative efficiency analysis of the Indian public sector banking business using DEA. It also examines the efficiencies of banks by analysing several efficiency metrics based on the scaling approach. Further, this study identifies the factors influencing interest and non-interest efficiencies of Indian PSBs. According to the DEA model (VRS), the top three most efficient Indian PSBs are Punjab & Sindh Bank, State Bank of India, and Canara Bank. The Central Bank of India, Indian Overseas Bank, and UCO Bank, on the other hand, are India's least efficient PSBs. The scaling technique reveals that only a few PSBs fared above the satisfactory threshold in two of the five categories, with most banks performing at or below the satisfactory level. Based on the aforesaid scaling approach, we awarded rankings to the PSBs. The most efficient bank is ranked first, while the least efficient bank is ranked twelve. Table 4 indicates that the State Bank of India, the Indian Bank, and the Bank of Baroda are the top 3 efficient Indian PSBs. In contrast, the Indian Overseas Bank, UCO Bank, and the Central Bank of India are the least efficient PSBs in India. The study also reveals some significant factors influencing the efficiency of Indian PSBs, such as cost of funds, cost to income, spread, NPAs, income per branch, bank size, etc.

In the modern Indian banking business, there is concern about the future of regulatory requirements, competition, rising cost to income, cost of funds, growing NPAs, quickly changing client tastes with unusually fast-growing technology and automation, escalating rivalry, and profitability constraints. In such a circumstance, efficiency management becomes more critical in banking. Only an up-to-date examination of the bank's performance relative to its competitors can ensure such development in efficiency, profits, and market value. This timely analysis regarding the bank's efficiency compared to the benchmark best feasible efficient banks gets the attention of the bank's decision-makers. Government officials and managers can go further into the reasons for inefficiency and develop internal skills to replicate the most outstanding performers by the Indian PSBs.

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MACRO ENVIRONMENTAL EFFECT ON SUSTAINABILITY OF TOURISM SECTOR: INDIAN EVIDENCE

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Abstract Sustainability of tourism sector measures through the revenue from tourism sector (IFTS). The Tourism sector of any country depends on various macro- and micro-environmental elements. In India, the tourism sector also depends on different macro-environmental elements like the Human Development Index (HDI), Political Stability Index (PSI), and Global Terrorism Index (GTI), etc. The objective of this study is to identify the effect of these selected elements on the revenue earned from the tourism sector of India and also to investigate the more influential element(s) for the sustainability of the tourism sector. Multiple variate regression analysis is used on twenty two years (1997–2018) annual data that is collected from the website of different national and international agencies and cross checked. It is observed that only one element among the three has a significant impact on the sustainability of the Indian tourism.

Keywords: Sustainability, Tourism Sector, HDI, PSI, GTI, Regression

INTRODUCTION

Economic prosperity of the nation depends on the activities of various sectors (see, Dreher, 2006; Rani et al., 2019). The tourism sector that works under the service sector plays an important role (Honey, 1999) for economic development. Various macro- and micro-environmental elements assist to measure its strength (see, Muhanna, 2007; Maheshwari et al., 2023). It is assumed that macro elements like Human Development, Political Stability, and Terrorism etc. have effect on tourism sector. Sustainability of tourism sector is essential for maintaining the growth of the country. It helps to generate more revenue. Hence, the sustainability of tourism sector is measured through the revenue generated from this sector. Here, the degree of Human Development, Political Stability, and Terrorism are measured through their respective indexes, i.e., Human Development Index (HDI), Political Stability Index (PSI), and Global Terrorism Index (GTI). Hence, it can be said that these indexes may have an effect on revenue earned from tourism sector (RVTS).

The remaining of this paper is designed as follows: Section-II presents a review of the literature and research gap. The objective of the study is depicted in section III. Section IV deals with collection of data and study period. Section V helps to define the formulation of hypotheses. Research

methodology is depicted in Section VI. Section VII highlights the analyses of the results and finally, conclusion and recommendation are given in Section VIII.

REVIEW OF LITERATURE AND RESEARCH GAP

The tourism sector may spread out peace throughout the world (International Institute for Peace through Tourism [IIPT], 2011). Since four decades the researchers on tourism (Allen, Long, Perdue & Kieselbach, 1988; Brougham & Butler, 1981; Cater, 1987; Cohen, 1978; Farrell & McLellan, 1987; Liu & Var, 1986; Smith, 1977; Turner & Ash, 1975; Young, 1973) have drawn their attention on the impact of economic, social, and environmental elements on tourism. Carlsen (1999) discusses that how demand of tourism will increase and the techniques for managing the destination of tourists. Griffith (2002) conducts a study and investigates the economic performance of tourism among four Caribbean communities. Chen (2006) in his study develops quantitative and qualitative model for assess the economic impact of tourism sector on society. Sharpley (2003) investigates that the overall development of Cyprus depends on the tourism sector. Belle and Bramwell (2005) investigate whether the environmental policy supports the tourism policy of their

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country or not. They also investigate that if there exists any gap between these two, then the tourism sector will be hampered. Shareef and McAlteer (2005) examine the impact of economic volatility of a country on the tourism sector and they identify that there is a negative impact. Sahli and Nowak (2007) conduct a study by considering the general macroeconomic equilibrium technique for measuring the impact of tourism on the overall development of the country and observing the negative impact of tourism on economic development in the developing country. The relationship between tourism and other export industries is calculated by Ghina (2003) in his study. Winson (2006) conducts a study and identifies that relatively large number of people engaged in the tourism industry than other sectors in Japan.

Kokkranikal et al. (2003) highlights on sustainable tourism and also explores the geographic, environmental, structural, and political limitations for the development of sustainable tourism sectors. The term 'sustainable tourism' is used by May (1991) and Nash & Butler (1990). The tourism sector has direct and indirect impacts on society and the environment. Here, impacts on air and water are called direct impacts. Similarly, the impact on manufacturers and transports are called indirect impact (Aall, 2011; Buckley & Araujo, 1997; Chan & Lam, 2003; Majumdar et al., 2020; Chawla et al., 2020). Tourism some time damages wildlife and creates negative impact on natural life (Buckley, 2004; Buckley, 2011a; Liddle, 1997; Nimon, Schroter & Stonehouse, 1995). In 1999, Honey, investigated the social and political impact on tourism in his study. Lane et al. (2009) in their study, identify that the tourism sector helps to enhance public relationship. Bojanic et al. (2009) conduct a study for evaluation of the relative importance of the tourism sector for Islands and regular countries. They use panel data of twelve years from 140 countries and reveal that Islands have lower capacity to accommodate travellers as compared to others but their GDP is highly influenced by the tourism sector than other countries.

So, the tourism sector is highly affected by various elements (environment, economic, and politics). Tourism and environmental policies should be coinciding for the development of the tourism sector. Few papers highlight that country's GDP totally depends on the tourism sector. The tourism sector is adversely affected by the economic shocks. Moreover, this sector creates negative impacts on wildlife and nature. Very few studies highlight the sustainable tourism. Although, environmental pollution creates a negative impact on sustainable tourism. Researchers around the world have dealt with various areas of the tourism sector but till now there exists a gap where the impact of the Human Development Index (HDI), Political Stability Index (PSI) and Global Terrorism Index (GTI) on the sustainability of the tourism sector is not covered and this study tries to fill

this gap and surely add value to the existing literature.

OBJECTIVE OF THE STUDY

Here, two-fold objectives are examined. At first, the effect of the selected factors on the revenue generated from the tourism sector is examined and thereafter, to identify the more influential element(s) for maintaining the sustainability of the Indian tourism sector.

DATA AND STUDY PERIOD

The study considers twenty two years of annual data starting from 1997 to 2018, and the variables are revenue generated from tourism sector (RVTS), HDI, PSI, and GTI, and the data are collected from their respective websites and cross checked with the data collected from the official website of the World Bank.

FORMULATION OF HYPOTHESES

The following hypotheses are formulated by taking into consideration of the environmental elements for testing:

H₁: There is a positive relationship between revenue generated from tourism sector and human development index (HDI).

H₂: There is a positive relationship between income from tourism sector and Political Stability Index (PSI).

H₃: There is a negative relationship between Global Terrorism Index (GTI) and revenue earned from Tourism Sector.

RESEARCH METHODOLOGY

The study uses two types of variables namely dependent variable and a set of independent variables. Here, income from the tourism sector is treated as dependent variable and human development index (HDI), political stability index (PSI), and also global terrorism index (GTI) are considered as exogenous variables.

The Human Development Index (HDI) is a combined measure of average achievement of key dimensions of human development, i.e., a long and healthy life, being knowledgeable and have a decent standard of living. The HDI is the geometric mean of normalised indices for each of the three dimensions (Human Development Report). A higher score indicates higher development of human life. Whereas, PSI represents the perception regarding stability of the Government. It also indicates the situation regarding stabilisation or destabilisation of the government. So, a higher score presents more stability and vis-à-vis. Finally,

the GTI is an attempt to present the systematic rank of the nations of the world according to the terrorist activities. The index combines a number of factors associated with terrorist attack and the index is developed by Institute for Economics and Peace (IEP) and is based on data from the Global Terrorism Database (GTD) which is collected and collated by the National Consortium for the Study of Terrorism and Responses to Terrorism (START) at the University of Maryland. A higher value of this index suggests high prone to terrorism activity and vis-à-vis. It varies between zero (0) and one (1) (Wikipedia).

The study uses log operator to convert the data into log form and then the Kolmogorov-Smirnov test is applied to check the normality of the data as under:

$$D = \text{Maximum} |F_o(X) - F_r(X)| \tag{1}$$

Where $F_o(X)$ = observed cumulative frequency distribution of a random sample of n observations and $F_o(X) = k/n$ (No. of observations $\leq X$)/(Total no. of observations).

$F_r(X)$ = the theoretical frequency distribution.

If the calculated value is less than the critical value then null hypothesis is accepted that means data is normal or vice-versa.

It is assumed that income generated from tourism sector is a function of HDI, PSI and GTI. So, it can be written as under:

$$RVTS = f(\text{HDI}, \text{PSI}, \text{GTI}) \tag{2}$$

This function can be presented in statistical sense as under:

$$RVTS = \alpha + \beta_1(\text{HDI}) + \beta_2(\text{PSI}) + \beta_3(\text{GTI}) \tag{3}$$

Here, equation 3 doesn't include error term and so the above model can be represented by taking into consideration the log form of the data in an econometric sense as under:

$$\text{LRVTS} = \alpha + \beta_1(\text{LHDI}) + \beta_2(\text{LPSI}) + \beta_3(\text{LGTI}) + e \tag{4}$$

Where, LRVTS indicates income earned from tourism sector; LHDI indicates human development index; LPSI index political stability index and finally, LGTI indicates global terrorism index and e is the error term with zero mean and constant standard deviation with the following properties: $E(e) = 0$, $\text{Var}(e) = \sigma^2 e$ and $\text{Cov}(e_i, e_j) = 0$ where $i \neq j$. α and β are the coefficients to be estimated by using equation 4.

The study uses the Durbin-Watson (d) test to check the autocorrelation problem in the regression residuals.

ANALYSIS OF RESULT

Table 1 highlights the descriptive statistics of the variables. It is found that the deviation of HDI (0.04433) among

sample years is lower as compared to the others. Here, the coefficient of variation signifies the consistency of the data. It is observed that the coefficient of variation of HDI (0.002) represents more consistency as compare to their counterparts. It indicates the fluctuation of data relating to HDI is very lower. It also highlights that the intensity of fluctuation of GTI in India is very high (3.163) during the sample period. It is also found that the fluctuation of political stability in India is 0.004, which indicates our country's development of human being is in a stable position.

Table 1: Descriptive Statistics

Dimensions	Mean	Std. Deviation	Coefficient of Variation
LRVTS	8.2432	0.84461	0.713
LHDI	1.7453	0.04433	0.002
LPSI	0.0728	0.06489	0.004
LGTI	1.7665	1.77862	3.163

Note: Authors' own calculation.

It is observed from Table 2 that the probability values of the Kolmogorov-Smirnov test statistics of the variables are higher than five percent meaning that acceptance of the null hypotheses or in other words the data are normally distributed.

Table 2: Test of Normality

Variable	Kolmogorov-Smirnov		
	Statistic	df	Probability
LRVTS	0.131	20	0.090
LHDI	0.090	20	0.200
LPSI	0.157	20	0.200
LGTI	0.187	20	0.064

Note: Authors' own calculation.

The outcome of the regression equation is presented in Table 3. The coefficient of the human development index (HDI) is positive and statistically significant which indicates that HDI positively and significantly influenced the income from generated from the tourism sector of India during the study period. But the coefficient of political stability is positive but not significant. Finally, the coefficient of the GTI is negatively influences income from the tourism sector although the coefficient is insignificant that means if terrorism activity increases in a country then income from tourism sector will be in a decreasing trend. It is also observed from the table that the disturbances terms are free from the autocorrelation problem as the Durbin-Watson test statistic is 1.80.

Table 3: Regression Estimates

Coefficients	Beta	T-Statistic	Probability	D-W
HDI	0.899	8.791*	0.000	1.80
PS	0.023	0.190	0.851	
GTI	-0.076	-0.627	0.539	

*Significance at 5% level.

Note: Authors' own calculation.

CONCLUSION AND RECOMMENDATION

Income from the tourism sector of India is influenced by all sample elements. This study is conducted on twenty two years of data on three environmental elements by using the multiple regression method. The result of this study reveals that the effects of three elements satisfy the hypotheses. Out of these three, only the HDI has a significant impact on Income from tourism sector. PSI has positive impact on income from the tourism sector of India but it is insignificant like GTI. Impacts of GTI on Income from tourism sector show that terrorism activity of India decreases the degree of flow of tourism sector. It can be concluded that all three variables have impact on Income from tourism sector but HDI act as more influential factor on it. So sustainability of income from tourism sector of India strongly depends of education, health and income as well as the political stability of the country.

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EXPLORING MARKET EFFICIENCY OF THE S&P BSE CARBONEX: A QUANTITATIVE STUDY

Mithilesh Gidage*, Shilpa Bhide**

Abstract *The Principles for Responsible Investment (PRI) emphasise the fundamental connection between adhering to ESG standards and managing investment risk effectively, revealing that non-compliant companies carry a 28 per cent higher annual risk compared to their ESG-compliant counterparts. This relationship underscores the importance of integrating sustainability practices into financial performance and aligns with the Efficient Market Hypothesis (EMH), which suggests that market information is quickly incorporated into stock prices, thereby constraining investors' capacity to achieve superior returns. This study utilises a quantitative research approach to examine the conformity of 17 companies listed on the BSE Carbon Index with the principles of the EMH. Daily, weekly, and monthly data were collected, and statistical tools such were employed for analysis. The findings suggest a deviation from the Random Walk Hypothesis within the stock return series, leading to the rejection of the formulated hypotheses. The empirical findings challenge the applicability of the EMH within the S&P BSE CARBONEX, urging investors to consider sustainability practices in their investment decisions. These insights are pivotal for stakeholders navigating sustainability-focused investment landscapes, providing valuable guidance for aligning investment strategies with sustainability imperatives.*

Keywords: *S&P BSE CARBONEX, Indian Stock Market, Efficient Market Hypothesis (EMH), Environmental, Social, and Governance Scores, and Random Walk Hypothesis*

INTRODUCTION

Understanding the efficiency of capital markets is essential for grasping the dynamics of financial markets. This involves delving into how capital markets operate, particularly the process of generating fundamental prices (Arora, 2013). In capital markets, where retail investors willingly take on risk in order to pursue higher returns (Potocki & Swist, 2015), they collect relevant information about stock prices and returns. This information is then used to anticipate future movements in stocks (Dash, 2020). EMH, formulated by E. Fama in 1970 as the 'theory of market efficiency,' suggests retail investors cannot consistently beat the market. Bachelier (1990) contributed the fundamental idea that stock price movements are unpredictable, independent, and unrelated. According to the EMH, stock prices already incorporate all available market information (Nelmidia, 2020). In such markets, investors utilise available information to analyse past stock movements, interpret current trends based on historical data, and forecast future movements (Bustanji, 2020).

In the current era, as the world pursues sustainability goals and sustainable development, businesses and corporate entities are increasingly prioritising sustainability practices and adopting Environmental, Social, and Governance (ESG) principles (Raja, 2018; Mandal & Mitra, 2023). ESG, which centres on the environmental, social, and governance pillars (Kadam, 2019), holds significance because an organisation's financial performance, as gauged by financial metrics, influences not only its sustainability but also that of society (Sunelwala et al., 2022). As a result, assessing sustainability, responsibility, and ethical practices becomes essential, mirroring the scrutiny applied to Corporate Financial Performance (CFP) (Rahul, 2016; Swain et al., 2023).

As per the PRI, investments made in companies which does not considers ESG entail a 28 per cent higher annual risk than investments in ESG-compliant companies. According to CRISIL (2021), companies that adhere to ESG principles are thought to exhibit a positive correlation with their CFP. Conversely, those companies lacking ESG compliance are reported to experience notable short-term declines in stock returns. This observation aligns with the concept of the

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EMH, which suggests that all available market information is already reflected in stock prices, thus making it challenging for investors to outperform the market. In the context of ESG compliance, information about a company's adherence to ESG principles is readily available, reinforcing the EMH notion that investors utilise market information to assess past, present, and future stock movements (Han et al., 2019).

According to Song et al. (2021), EMH stands as a cornerstone, sparking ongoing debates due to its assertion that listed stocks trade at fair value, making it challenging for retail investors to surpass the market through undervalued purchases or selling at inflated prices. As reported in CRISIL's ESG compendium 2021, in the realm of ESG-based investing, if the EMH holds true for stocks with significant ESG scores, expertise in portfolio management or market timing would not lead to outperformance. This forms the rationale of the current study.

The study refrains from scrutinising the EMH for each stock's movement based on CRISIL's ESG scores for 1,000 companies across approximately 65 sectors for the fiscal year ending 2022. Instead, it focuses on companies listed in the S&P BSE CARBONEX from different industries, exhibiting noteworthy ESG scores in CRISIL's ESG 2022. The BSE CARBONEX index integrates forward-thinking criteria, assessing the anticipated impacts of climate change and corresponding economic responses. Companies that grasp these risks and opportunities and strategically position themselves accordingly are anticipated to yield superior long-term returns compared to those that do not adapt. (S&P BSE CARBONEX Methodology, 2014). The research seeks to empirically examine the performance of the index concerning sustainability practices within the Indian capital market, specifically focusing on the CARBONEX. Hence, the research seeks to ascertain if market prices of stocks of firms which are listed in CARBONEX with substantial ESG scores align with the EMH. The objectives of the research remain twofold:

- To analyse and understand the monthly, weekly, and daily fluctuations in stock returns within CARBONEX.
- To assess if the monthly, weekly, and daily stock returns of the CARBONEX demonstrate efficiency in weak form.

LITERATURE REVIEW

EMH continues to be a subject of debate and contention, with various studies yielding mixed results due to differences in timing and indices. For this study, a thorough literature review has been conducted, as outlined below:

To evaluate efficiency in weak form using daily data from NSE and BSE, over the past five years from 1999 to 2004,

Khan in 2006 concluded that the random walk hypothesis was rejected for both exchanges. The investigation revealed negative autocorrelation in daily data and noted an increasing departure from normality over time. Conversely, Raj and Kumari (2006) explored the existence of seasonal effects, such as the January effect and the Monday effect, in the same period. While these effects were not found to be prevalent in the Indian capital market, the study concluded that the market operates within the realm of the weak form of the EMH. The findings of Raj and Kumari (2006) and Khan (2006) offer contrasting perspectives on the efficiency of the Indian capital market.

Pandey (2003) utilised daily and weekly closing data from three stock indices- CNX Defty, NIFTY 50, and NIFTY Next 50- in an effort to examine the efficiency of the Indian capital market. The study applied run tests and ACF to analyse six years of data spanning from January 1996 to June 2002. However, the findings did not support the random walk hypothesis in the Indian Stock Market. Poshakwale (1996), analysing the daily BSE Index data from 1987 to 1994, reported market inefficiency in the Indian capital market. In a recent examination conducted by Sarkar (2019), the weak form market efficiency of both the BSE and NSE was evaluated. The findings indicated that the Indian Stock Exchange lacks efficiency, even in its weak form, as share prices fail to adequately reflect available market information. Furthermore, the study highlighted that the Indian Stock market offers opportunities for investors to attain abnormal profits by leveraging historical information. Ramkumar et al. (2014) reached similar conclusions, indicating that neither the five indices from the BSE nor those from the NSE displayed weak form efficiency. Mishra et al. (2009) utilised well-established tests such as the PP test and the KPSS unit root test on data from both exchanges. Their findings revealed stationary series without a unit root, consistent with existing literature suggesting that the Indian stock market does not adhere to the random walk hypothesis and lacks efficiency even in its weak form. Additional research by Hassan (2013); Bisen and Pandey (2015) provides further support for the notion that the Indian capital market may lack efficiency in its weak form. This suggests that there could be opportunities for investors to capitalise on market inconsistencies and generate abnormal profits by forecasting future stock price movements.

Nevertheless, it's crucial to acknowledge that the literature on the EMH presents varied findings. While some studies offer evidence that the Indian stock market adheres to the random walk model, supporting the EMH, others suggest otherwise. In 1977, Sharma and Kennedy conducted a comparative study, which is a behavioural analysis of leading indices from Mumbai, New York, and London over a ten-year period from 1963 to 1973, and concluded that

securities listed on the BSE demonstrated a random walk as well as the efficiency in the weak form. Dhankar (1991) conducted empirical tests on the random walk hypothesis in the Indian stock market, employing run tests and serial correlation tests. The findings confirmed the presence of a random walk of share prices and asserted the presence of weak-form market efficiency. Chavannavar and Patel (2016) utilised run tests and Auto-correlation Function (ACF) to analyse the Nifty 20 Index and Nifty 50 stocks. Their findings suggested that movements in stock prices on the Indian Stock Exchange are independent. Research conducted by Kumar et al. (2020), Zafar (2012), and Patrick and Sushama (2011) likewise corroborate the assertion that the Indian stock market displays weak-form efficiency.

The literature on the EMH has yielded diverse outcomes for the Indian capital market, attributed to differences in timeframes and the utilisation of various stock indices across different sectors and industries. It is important to highlight that while there is abundant literature on EMH for several stock indices, research on carbon index or ESG investing is still relatively nascent. This is particularly noteworthy given the substantial influence of sustainable investment on the capital market. Past research has primarily focused on analysing the performance of listed stocks across various indexes. However, this study distinguishes itself by exclusively examining the performance of CARBONEX, which evaluates its listed stocks based on sustainability practices such as carbon performance. In today's age of ESG investing, where businesses and corporations are increasingly prioritising sustainability practices, this study fills a crucial research gap by investigating the relationship between sustainability and the stock market. It achieves this objective by testing the EMH of the BSE Carbon Index (BSE

CARBONEX), which has notable ESG scores reported by CRISIL in 2022.

In alignment with the existing literature and the study's objectives, this research will empirically test three hypotheses:

H1: Daily equity returns exhibit weak-form efficiency.

H2: Weekly equity returns exhibit weak-form efficiency.

H3: Monthly equity returns exhibit weak-form efficiency.

These hypotheses are designed in order to evaluate the extent to which the BSE-CARBONEX adheres to the EMH in its weak form, with a focus on different time intervals- monthly, weekly, and daily stock returns. Research aims to contribute insights into the efficiency of sustainable stocks within the Indian stock market.

RESEARCH METHODOLOGY

Using a quantitative research design, this study empirically examines the EMH of the Carbonex. Specifically, the study focuses on 17 out of the 30 companies listed in the Carbonex, which have significant ESG scores according to CRISIL ESG Scores 2022.

These 17 companies are Infosys Limited, Tech Mahindra Limited, LTIMindtree Limited, Tata Consultancy Services Limited, Wipro Limited, HCL Technologies Limited, Persistent Systems Limited, Tata Consumer Products Limited, State Bank of India, Gail India Limited, Larsen and Toubro Limited, AU Small Finance Bank Limited, Cholamandalam Investment and Finance Company Limited, ICICI Bank Limited, Cipla Limited, ICICI Prudential Life Insurance Company Limited, and Yes Bank Limited.

Table 1: CRISIL ESG Scores 2022 for CARBONEX Components

Company Name	Series Name	Sector Classification	ESG Score	Category
Infosys Limited	INFY	IT	76	Leadership
Oil and Natural Gas Corporation Limited	ONGC	Oil & Gas - Exploration & Production	47	Adequate
Tech Mahindra Limited	TECHM	IT	76	Leadership
LTIMindtree Limited	LTIM	IT	66	Strong
Tata Consultancy Services Limited	TCS	IT	76	Leadership
Wipro Limited	WIPRO	IT	75	Leadership
HCL Technologies Limited	HCLTECH	IT	71	Leadership
Persistent Systems Limited	PERSISTENT	IT	66	Strong
Tata Consumer Products Limited	TATACONSUM	FMCG	63	Strong
Info Edge (India) Limited	NAUKRI	Internet	54	Adequate
State Bank of India	SBIN	Banks	63	Strong
Gail India Limited	GAIL	Oil & Gas - Gas	63	Strong

Company Name	Series Name	Sector Classification	ESG Score	Category
Larsen and Toubro Limited	LT	Diversified	63	Strong
Bank of Baroda	BANKBARODA	Banks	55	Adequate
Power Finance Corporation Limited	PFC	DFI-Listed	54	Adequate
AU Small Finance Bank Limited	AUBANK	Banks	68	Strong
Indian Oil Corporation Limited	IOC	Oil & Gas - Refining & Marketing	58	Adequate
Cholamandalam Investment and Finance Company Limited	CHOLAFIN	NBFC	60	Adequate
Grasim Industries Limited	GRASIM	Diversified	57	Adequate
ICICI Bank Limited	ICICIBANK	Banks	64	Strong
Varun Beverages Limited	VBL	FMCG	50	Adequate
PI Industries Limited	PIIND	Chemicals - Speciality Chemicals	53	Adequate
Bajaj Finserv Limited	BAJAJFINSV	Holding company	58	Adequate
Ambuja Cements Limited	AMBUJACEM	Cement	52	Adequate
APL Apollo Tubes Limited	APLAPOLLO	Metals - Linked Products	56	Adequate
Apollo Hospitals Enterprise Limited	APOLLOHOSP	Healthcare	57	Adequate
Cipla Limited	CIPLA	Pharmaceuticals	69	Strong
Bharat Forge Limited	BHARATFORG	Auto Ancillary	57	Adequate
ICICI Prudential Life Insurance Company Limited	ICICIPRULI	Insurance	63	Strong
Yes Bank Limited	YESBANK	Banks	63	Strong

Source: CRISIL ESG Scores 2022.

The selection criteria for the 17 companies was based on their mean ESG scores, with each having scores equal to or above the mean ESG score of 60. These companies constitute the total of 17 listed in the Carbonex with ESG scores meeting or exceeding this threshold. Subsequently, their daily, weekly, and monthly closing prices were extracted from the BSE's website for a 5-year period spanning from January 1, 2015, to December 31, 2019. The rationale behind this timeframe selection was to analyse recent data while excluding the period affected by the COVID-19 pandemic in India. Thus, the study opted for a five-year data period that specifically avoided the pandemic period, ensuring robust analysis of the indices' performance.

The calculation of daily, weekly, and monthly returns is as follows (Shefali & Kour, 2021):

$$R_t = \text{Log} (P_t / P_{t-1})$$

where R_t is the stock return at time 't', P_t is the closing stock price at time 't' and P_{t-1} is the closing stock price at time 't-1'.

In assessing the weak form of market efficiency or testing the EMH using stock return data, various statistical tests were employed. One such test is the Kolmogorov-Smirnov Goodness of Fit Test, which serves as a non-parametric statistic to determine whether the stock return adheres to a specific theoretical distribution. This test entails examining

whether the randomly selected daily, weekly, and monthly stock returns follow a normal distribution. The Kolmogorov-Smirnov Goodness of Fit Test evaluates the null hypothesis that the series conforms to a normal distribution, with the conclusion drawn based on the computed probability value (p-value). A p-value greater than 0.05 indicates acceptance of the null hypothesis, signifying that the series is normally distributed (Press et al., 2007).

The ACF is widely recognised as a parametric test commonly employed for assessing the EMH. This test examines the relationship between the stock return at time 't' and the return from the same stock at time 't-1'. Essentially, it evaluates the correlation between the current period's return and the return from the immediate previous period. The ACF provides insights into the pattern of autocorrelation within the random series, illustrating the extent to which the series is correlated with its lagged values. Additionally, it indicates whether the autocorrelation significantly deviates from zero (Hamilton, 1994). In the context of the EMH, the null hypothesis posits the absence of autocorrelation. Moreover, the Ljung-Box Q-statistic (Q-stats) is another method employed to test the EMH hypothesis, specifically examining whether the autocorrelation coefficients (ρ_k) are zero for all computed lags (Ljung & Box, 1978).

The Run Test, a non-parametric or distribution-free test, is widely utilised in testing the EMH. Unlike parametric

tests, it does not necessitate the data to adhere to normal distribution or require homogeneity within the series. This test assesses the null hypothesis that the series represents a random variable, or in other words, that the movement of stock returns is random. The decision regarding this hypothesis is based on the probability value, commonly known as the p-value (sig.). If the p-value exceeds 0.05, indicating a significance level of 5%, the null hypothesis is accepted, signifying that the movement of stock returns is indeed random during the specified period (Siegel, 1956).

The Unit Root Test is utilised to determine whether the time series, specifically the stock returns examined in this study, are stationary or non-stationary. To assess stationarity, this study employs both the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test. The null hypothesis of

both unit root tests, including the ADF test and PP test, posits the presence of a unit root in the time series. In the context of the EMH, it is imperative for the series to be non-stationary, or in other words, to exhibit a random walk pattern (Dickey & Fuller, 1979; and Phillips & Perron, 1988).

RESULTS AND DISCUSSIONS

Previously, the normality of the series was assessed using the Kolmogorov-Smirnov Goodness of Fit Test, aimed at examining whether the series adhered to a normal distribution. The dataset comprised daily, weekly, and monthly stock returns spanning a period of five years, commencing from January 1st, 2015, to December 31st, 2019. The outcomes of the normality test have been detailed in Table 2.

Table 2: Normality Test Results using Kolmogorov-Smirnov Test

Return Series	Daily		Weekly		Monthly	
	Statistic	Statistical Significance	Statistic	Statistical Significance	Statistic	Statistical Significance
INFY	0.080	0.000	0.069	0.005	0.099	0.200
TECHM	0.064	0.000	0.063	0.015	0.059	0.200
LTIM	0.055	0.000	0.066	0.008	0.074	0.200
TCS	0.067	0.000	0.09	0.000	0.101	0.200
WIPRO	0.452	0.000	0.136	0.000	0.174	0.000
HCLTECH	0.009	0.000	0.066	0.007	0.066	0.200
PERSISTENT	0.043	0.000	0.069	0.004	0.086	0.200
TATACONSUM	0.077	0.000	0.061	0.021	0.062	0.200
SBIN	0.084	0.000	0.058	0.068	0.065	0.200
GAIL	0.042	0.000	0.069	0.005	0.082	0.200
LT	0.060	0.000	0.058	0.068	0.085	0.200
AUBANK	0.055	0.000	0.064	0.011	0.066	0.200
CHOLAFIN	0.059	0.000	0.104	0.000	0.061	0.200
ICICIBANK	0.031	0.004	0.041	0.200	0.062	0.200
CIPLA	0.066	0.000	0.074	0.001	0.077	0.200
ICICIPRULI	0.061	0.000	0.078	0.001	0.106	0.092
YESBANK	0.038	0.001	0.041	0.200	0.067	0.200

*Lilliefors Significance Correction.

Source: Provided by authors.

According to the results of the Kolmogorov-Smirnov Goodness of Fit Test, it was observed that the daily stock return series did not adhere to a normal distribution, as indicated by the rejection of the null hypothesis at a 5 per cent significance level. Conversely, for the monthly stock return series, the null hypothesis was accepted at the 5 per cent level of significance, suggesting normal distribution. Regarding the weekly return series, it was found that the stock return series of SBIN, LT, ICICIBANK, and YESBANK exhibited

normal distribution, while the remaining series displayed deviations from normality.

Given the presence of both normally distributed and non-normally distributed series within the dataset, the study employs the run test as a distribution-free test and the Auto-correlation Test as a parametric test to assess adherence to the EMH. The outcomes of the run test, aimed at evaluating the randomness of stock return movement, are delineated in Table 3.

Table 3: Results for the Run Test

Series	Daily Returns			Weekly Returns			Monthly Returns		
	Number of Runs	Z	Sig	Number of Runs	Z	Sig	Number of Runs	Z	Sig
INFY	20	-34.09	0.000	4	-15.81	0.000	6	-6.56	0.000
TECHM	6	-34.67	0.000	6	-15.56	0.000	4	-7.09	0.000
LTIM	45	-32.27	0.000	20	-13.82	0.000	12	-5.01	0.000
TCS	25	-34.03	0.000	9	-15.18	0.000	5	-6.84	0.000
WIPRO	8	-24.76	0.000	4	-15.81	0.000	2	-7.55	0.000
HCLTECH	15	-34.55	0.000	4	-15.81	0.000	2	-7.61	0.000
PERSISTENT	18	-33.52	0.000	11	14.88	0.000	7	-6.17	0.000
TATACONSUM	33	-33.07	0.000	12	-14.73	0.000	6	-6.52	0.000
SBIN	38	-33.41	0.000	18	-14.07	0.000	6	-6.58	0.000
GAIL	54	.32.120	0.000	27	-12.85	0.000	13	-4.58	0.000
LT	18	-34.19	0.000	8	-15.3	0.000	6	-6.56	0.000
AUBANK	43	-32.99	0.000	11	-14.77	0.000	7	-6.068	0.000
CHOLAFIN	20	-33.86	0.000	10	-15.06	0.000	6	-6.489	0.000
ICICIBANK	33	-34.42	0.000	6	-15.54	0.000	2	-7.547	0.000
CIPLA	43	-34.77	0.000	2	-16.06	0.000	2	-7.548	0.000
ICICIPRULI	18	-34.33	0.000	8	-15.31	0.000	4	-7.03	0.000
YESBANK	18	-34.27	0.000	6	-15.51	0.000	6	-6.419	0.000

*Test Value: Mean.

Source: Provided by Authors.

The null hypothesis posited by the run test asserts that the movement of data within the series, specifically the stock return in this context, adheres to a random pattern. The findings presented in Table 3 unequivocally reject the null hypothesis across all series, encompassing daily, weekly, and monthly stock returns. This unequivocally indicates that

the movement of stock returns does not adhere to a random pattern and does not conform to the principles of the random walk model.

Following the run-test analysis, the study proceeds to present the outcomes of the ACF in Table 4 and the Ljung-Box Q-statistics in Table 5.

Table 4: Results of the Auto-Correlation Function (ACF)

	INFY			TECHM			LTIM		
	Daily	Weekly	Monthly	Daily	Weekly	Monthly	Daily	Weekly	Monthly
1	-0.001	0.000	0.007	0.029	-0.036	-0.002	-.056**	-0.034	-0.223
2	0.003	-0.024	-.258**	-0.010	0.051	-0.232	-0.015	0.004	0.162
3	-0.016	-0.100	-0.033	0.009	-0.001	0.018	-0.018	-0.066	-0.229
4	-0.033	0.081	-0.142	-0.018	0.088	-0.129	0.021	-0.024	0.011
5	0.023	0.011	-0.052	-0.031	0.067	-0.139	-0.005	-0.056	-0.214
6	-0.056**	0.102	-0.014	-0.049	0.012	0.063	0.014	-0.004	0.098
7	-0.008	0.023	-0.096	-0.004	-0.043	-0.081	0.001	0.019	-0.198
8	-0.008	-0.120	-0.109	0.010	-.138**	-0.073	-0.051	0.005	0.141
9	0.021	-0.100	-0.057	0.039	0.002	0.179	-0.003	0.011	0.080
10	0.040	0.013	0.183	0.027	-0.137	0.134	0.031	0.053	0.152
11	-0.020	-0.060	0.091	0.003	-0.016	-0.044	0.031	0.073	-0.126
12	-0.043	-0.001	-0.045	-0.004	0.004	0.049	-0.016	-0.051	0.053
13	0.031	-0.096	0.168	-0.007	-0.075	0.014	0.021	-.124**	-0.118
14	-0.058**	-0.042	0.082	-0.034	0.082	-0.170	-0.053	-0.079	-0.058
15	-0.029	-0.033	-0.015	-0.025	-.135**	-0.024	-0.020	0.059	0.025
16	0.019	-0.014	0.031	.081*	-0.058	0.102	0.014	-0.092	0.019

	TCS			WIPRO			HCLTECH		
	Daily	Weekly	Monthly	Daily	Weekly	Monthly	Daily	Weekly	Monthly
1	.080*	-0.028	-0.178	0.000	-0.022	-0.129	-0.035	0.026	0.038
2	0.023	-0.049	0.103	0.002	-.122**	-0.200	-0.014	-0.068	-0.170
3	-0.003	-0.016	-0.047	0.000	-0.020	-0.061	-0.003	-0.077	-0.129
4	-0.019	-0.111	-0.082	-0.001	-0.057	-0.137	.064**	0.050	0.062
5	0.000	-0.061	0.033	0.000	0.022	0.125	-0.025	0.000	0.136
6	-0.016	-0.003	-0.112	-0.001	0.054	-0.001	-0.019	0.054	0.046
7	-0.011	-0.011	-0.049	-0.002	-0.098	0.092	0.007	0.000	-0.094
8	-0.037	-0.088	0.136	0.000	-0.052	-0.077	-0.005	-0.003	-0.109
9	-0.018	0.039	-0.064	0.003	-0.018	-0.037	-0.031	-0.088	-0.041
10	0.018	0.011	-0.032	0.001	0.058	0.063	-0.022	-0.103	-0.047
11	.065**	0.100	-0.077	0.002	0.017	-0.135	0.011	0.072	0.134
12	-0.047	0.014	0.041	0.000	-0.054	0.091	-0.023	0.046	-0.019
13	0.018	-0.043	0.094	0.001	-0.026	-0.002	0.004	-0.073	0.018
14	-0.048	0.008	0.010	-0.001	-0.052	-0.113	-0.005	-0.044	0.080
15	-0.024	-0.025	0.068	0.003	-0.101	0.055	-0.018	-0.046	0.000
16	-.076*	-0.029	0.059	-0.004	0.033	0.057	0.025	-0.024	-0.100
	PERSISTENT			TATACONSUM			SBIN		
	Daily	Weekly	Monthly	Daily	Weekly	Monthly	Daily	Weekly	Monthly
1	0.018	-.122**	-0.115	0.020	-.202*	-0.157	0.019	0.004	0.113
2	-0.007	0.011	-0.082	-0.041	-0.003	-0.163	-0.048	0.034	-.247**
3	-0.005	-0.108	0.114	-.10*	-0.054	0.035	0.018	-0.059	0.072
4	-.059**	0.044	-0.116	-.06**	-0.041	-0.050	-0.022	-0.012	0.025
5	-0.054	-.123**	0.014	-0.020	0.064	-0.032	-0.010	0.046	-0.138
6	-0.022	0.071	0.122	-0.030	0.020	0.186	-0.015	0.065	-0.061
7	0.014	-0.043	0.153	-0.014	-0.080	-0.089	0.017	-0.097	-0.109
8	-0.023	-0.052	-0.058	0.017	0.076	0.047	0.004	-0.111	-0.217
9	0.010	-0.057	0.014	-0.005	-0.076	0.045	0.023	0.004	0.043
10	0.028	0.065	0.006	-0.039	-0.087	-0.050	-0.017	0.001	.256**
11	-0.012	0.017	0.044	0.015	0.008	0.103	0.008	-0.009	0.026
12	-0.003	0.104	0.053	0.028	-0.083	-0.030	-0.013	0.068	-0.110
13	-0.017	-0.035	-0.204	-0.010	0.030	-0.053	0.011	-0.065	0.007
14	-0.039	0.071	0.094	0.000	0.056	0.150	-0.055	0.114	0.034
15	-0.042	-0.027	0.077	-0.045	0.004	0.098	0.013	-0.060	-0.168
16	0.030	0.052	-0.080	-0.016	0.018	-0.177	-0.004	0.130	0.051
	GAIL			LT			AUBANK		
	Daily	Weekly	Monthly	Daily	Weekly	Monthly	Daily	Weekly	Monthly
1	-0.038	0.009	-0.030	0.009	0.087	-0.003	0.032	0.025	-0.239
2	0.006	-0.076	-0.173	-0.014	0.066	0.008	-0.046	0.040	-0.025
3	-0.008	-0.090	-0.021	0.021	-.133**	-0.182	-0.034	-0.069	0.126
4	0.020	-0.009	0.158	-0.025	-0.074	-0.043	0.033	-0.062	-0.019
5	-0.027	0.041	-0.049	-0.045	0.019	-0.007	-0.013	-.147*	0.241
6	0.000	0.027	-0.043	.070**	0.088	0.049	-0.020	-0.045	-0.094
7	0.036	0.025	0.078	0.033	.121**	-0.065	.060**	-0.030	0.005
8	-0.020	-0.039	-0.161	-0.040	-0.113	-0.004	-0.001	0.002	-0.034
9	-0.024	-.185*	-0.025	0.051	0.023	0.229	-0.004	-0.101	-0.115
10	0.022	0.090	0.185	-0.009	-0.031	0.048	0.046	.153**	0.147
11	0.000	-0.013	0.023	0.014	0.017	-0.122	0.015	0.019	-0.070
12	-.066**	0.066	-0.178	0.001	0.011	-0.166	-0.018	0.148	-0.105
13	-.089*	-0.019	0.020	0.006	-0.038	-0.188	-0.026	-0.003	-0.124
14	0.032	-0.088	0.008	-.066**	-0.054	0.148	-0.035	0.061	-0.065
15	-0.043	-0.032	-0.105	0.012	0.026	0.032	0.030	-.176*	-0.031
16	0.038	.127**	-0.108	-0.004	0.061	0.048	-0.052	0.033	0.063

	CHOLAFIN			ICICIBANK			CIPLA		
	Daily	Weekly	Monthly	Daily	Weekly	Monthly	Daily	Weekly	Monthly
1	0.032	-0.010	-0.150	-0.033	-0.009	-0.110	0.041	-0.084	-0.110
2	-0.012	-0.072	-0.055	-0.015	0.059	0.206	-0.027	0.051	-.312**
3	-0.031	-0.039	-0.177	0.020	-0.086	0.138	-0.010	-0.011	0.089
4	0.010	-0.078	-0.013	0.033	-0.054	-0.014	-0.041	-0.054	0.152
5	-0.001	-0.031	-0.095	-0.031	0.005	.284**	0.005	-0.053	-0.180
6	-0.003	.121**	-0.043	-0.028	-0.043	-0.003	-.066**	-0.042	-0.156
7	-0.017	-0.037	0.143	0.025	0.094	-0.099	-0.054	-0.047	-0.055
8	0.035	-0.059	-0.042	-0.024	-0.045	0.167	0.042	-0.086	0.011
9	-0.024	0.058	0.151	0.029	0.031	-0.186	0.029	-0.009	0.035
10	-0.032	-0.037	-0.060	0.013	0.027	-0.012	0.017	-0.097	0.016
11	-0.029	0.053	-0.073	0.023	0.064	-0.008	-0.049	0.021	0.065
12	0.007	-0.050	-0.023	-.056**	.212*	-.297**	0.009	0.006	-0.004
13	0.023	-.122**	-0.175	0.022	-0.078	0.204	0.014	-0.037	0.066
14	0.004	-0.043	0.104	-0.017	0.038	-0.220	0.000	-0.054	-0.036
15	-0.011	-0.084	-0.073	-0.008	-0.039	0.000	-.059**	0.044	0.083
16	-0.028	-0.071	0.028	0.026	.139**	0.038	0.018	0.080	-0.042
	ICICIPRULI			YESBANK					
	Daily	Weekly	Monthly	Daily	Weekly	Monthly			
1	0.052	0.000	0.052	-0.049	-0.083	-0.217			
2	-0.020	0.025	-0.175	-0.026	-0.058	-0.084			
3	-0.007	0.019	-0.017	-.080*	0.074	0.072			
4	0.032	0.003	0.141	0.004	-.123**	0.070			
5	-.060**	0.073	-0.076	-0.021	0.037	-0.082			
6	-0.008	0.045	0.090	-0.022	0.014	0.063			
7	0.024	-0.002	-0.068	-0.028	-0.100	0.097			
8	-0.027	-0.010	-0.059	-0.006	-0.068	-0.021			
9	0.006	-0.035	0.049	-0.009	-0.075	-0.168			
10	0.011	-0.066	0.191	0.045	0.021	0.193			
11	0.015	-0.045	-0.004	-0.023	0.108	-0.067			
12	-0.017	-0.112	-0.145	0.013	-0.010	-0.095			
13	-0.002	.160*	-0.114	-0.012	-0.056	0.044			
14	0.020	-0.069	0.094	0.024	.126**	-0.043			
15	-0.010	-0.067	-0.038	0.016	0.020	-0.087			
16	0.001	0.074	-0.017	0.006	-0.004	0.069			

Source: Provided by authors.

Table 5: Results of the Ljung-Box Q (LBQ) Statistic Tests

	INFY			TECHM			LTIM		
	Daily	Weekly	Monthly	Daily	Weekly	Monthly	Daily	Weekly	Monthly
1	0.000	0.000	0.003	1.053	0.337	0.000	3.830	0.313	3.192
2	0.011	0.158	4.349	1.174	1.022	3.507	4.127	0.316	4.909
3	0.344	2.819	4.424	1.284	1.022	3.528	4.543	1.468	8.372**
4	1.718	4.577	5.787	1.677	3.076	4.653	5.073	1.619	8.381
5	2.390	4.607	5.970	2.836	4.274	5.982	5.108	2.456	11.54**
6	6.316	7.409	5.983	5.859	4.314	6.263	5.351	2.461	12.203
7	6.400	7.551	6.639	5.882	4.806	6.728	5.353	2.555	14.98**
8	6.475	11.435	7.494	5.996	9.982	7.117	8.528	2.561	16.43**
9	7.024	14.168	7.735	7.922	9.983	9.490	8.541	2.593	16.902

	INFY			TECHM			LTIM		
	Daily	Weekly	Monthly	Daily	Weekly	Monthly	Daily	Weekly	Monthly
10	9.055	14.211	10.249	8.849	15.121	10.839	9.695	3.370	18.65**
11	9.536	15.206	10.890	8.862	15.189	10.988	10.862	4.849	19.87**
12	11.822	15.207	11.048	8.880	15.194	11.180	11.168	5.568	20.098
13	13.021	17.736	13.312	8.942	16.750	11.196	11.694	9.850	21.217
14	17.335	18.225	13.867	10.362	18.601	13.572	15.191	11.590	21.490
15	18.349	18.528	13.886	11.140	23.709	13.621	15.676	12.576	21.542
16	18.822	18.580	13.966	19.373	24.641	14.515	15.921	14.963	21.573
	TCS			WIPRO			HCLTECH		
	Daily	Weekly	Monthly	Daily	Weekly	Monthly	Daily	Weekly	Monthly
1	7.934*	0.203	2.034	0.000	0.129	1.056	1.489	0.172	0.090
2	8.590**	0.850	2.719	0.003	4.056	3.622	1.727	1.404	1.967
3	8.603**	0.922	2.866	0.003	4.168	3.862	1.740	2.984	3.076
4	9.031	4.186	3.316	0.004	5.041	5.117	6.756	3.662	3.334
5	9.031	5.183	3.389	0.005	5.169	6.169	7.542	3.662	4.600
6	9.342	5.186	4.268	0.005	5.951	6.169	7.986	4.450	4.747
7	9.499	5.220	4.440	0.012	8.538	6.758	8.045	4.450	5.374
8	11.206	7.302	5.777	0.012	9.259	7.183	8.078	4.452	6.230
9	11.622	7.712	6.078	0.027	9.347	7.284	9.238	6.553	6.352
10	12.044	7.743	6.156	0.028	10.274	7.581	9.846	9.438	6.516
11	17.263	10.514	6.610	0.032	10.356	8.968	9.997	10.863	7.893
12	20.036	10.572	6.740	0.032	11.152	9.615	10.630	11.437	7.922
13	20.457	11.094	7.447	0.034	11.342	9.616	10.647	12.928	7.948
14	23.277	11.113	7.455	0.036	12.080	10.646	10.684	13.456	8.469
15	24.014	11.293	7.843	0.046	14.908	10.894	11.086	14.056	8.469
16	31.27**	11.524	8.136	0.063	15.211	11.173	11.877	14.215	9.322
	PERSISTENT			TATACONSUM			SBIN		
	Daily	Weekly	Monthly	Daily	Weekly	Monthly	Daily	Weekly	Monthly
1	0.397	3.94**	0.854	0.482	10.74**	1.574	0.437	0.004	0.818
2	0.456	3.980	1.294	2.541	10.74**	3.299	3.265	0.306	4.782
3	0.481	7.097	2.152	15.127*	11.51**	3.381	3.683	1.235	5.124
4	4.797	7.618	3.057	20.429*	11.96**	3.552	4.264	1.273	5.165
5	8.467	11.6**	3.071	20.910*	13.04**	3.623	4.383	1.834	6.469
6	9.053	13.0**	4.110	21.996*	13.15**	6.045	4.660	2.967	6.732
7	9.312	13.520	5.784	22.233*	14.88**	6.612	5.007	5.524	7.577
8	9.978	14.270	6.029	22.605*	16.45**	6.769	5.027	8.842	11.007
9	10.105	15.150	6.045	22.630*	18.02**	6.921	5.681	8.846	11.146
10	11.078	16.310	6.047	24.475*	20.09**	7.110	6.058	8.846	16.068
11	11.258	16.380	6.198	24.748*	20.11**	7.922	6.140	8.868	16.122
12	11.269	19.350	6.418	25.70**	22.01**	7.991	6.338	10.140	17.072
13	11.613	19.690	9.758	25.82**	22.262	8.213	6.481	11.316	17.076
14	13.516	21.110	10.470	25.82**	23.145	10.061	10.305	14.942	17.171
15	15.729	21.310	10.960	28.33**	23.150	10.856	10.510	15.935	19.522
16	16.846	22.060	11.510	28.64**	23.243	13.538	10.528	20.700	19.745

	GAIL			LT			AUBANK		
	Daily	Weekly	Monthly	Daily	Weekly	Monthly	Daily	Weekly	Monthly
1	1.758	0.022	0.057	0.103	1.977	0.001	1.232	0.162	3.590
2	1.805	1.557	2.008	0.342	3.148	0.005	3.822	0.581	3.630
3	1.883	3.724**	2.038	0.875	7.849	2.196	5.233	1.859	4.659
4	2.356	3.748	3.724	1.620	9.320	2.321	6.591	2.878	4.684
5	3.248	4.192	3.887	4.094	9.420	2.325	6.792	8.699	8.625
6	3.248	4.392	4.015	10.209	11.500	2.493	7.304	9.236	9.230
7	4.867	4.560**	4.452	11.521	15.470	2.790	11.709	9.483	9.231
8	5.359	4.966**	6.325	13.551	18.965	2.791	11.710	9.485	9.314
9	6.089	14.320**	6.372	16.762	19.110	6.675	11.728	12.258	10.273
10	6.684	16.537**	8.959	16.870	19.366	6.850	14.336	18.655	11.882
11	6.684	16.580	9.002	17.123	19.443	8.001	14.628	18.757	12.253
12	12.027	17.784	11.493	17.125	19.479	10.174	15.024	24.819	13.101
13	21.984	17.880	11.526	17.165	19.888	13.001	15.896	24.821	14.319
14	23.266	20.052	11.532	22.549	20.693	14.788	17.451	25.867	14.656
15	25.547**	20.331	12.453	22.737	20.884	14.871	18.548	34.551	14.737
16	27.385**	24.844	13.450	22.753	21.928	15.064	21.963	34.864	15.072
	CHOLAFIN			ICICIBANK			CIPLA		
	Daily	Weekly	Monthly	Daily	Weekly	Monthly	Daily	Weekly	Monthly
1	1.268	0.027	1.424	1.355	0.023	0.762	2.092	1.871	0.767
2	1.454	1.403	1.617	1.633	0.951	3.492	2.981	2.549	7.004**
3	2.643	1.817	3.668	2.146	2.934	4.737	3.115	2.580	7.519
4	2.757	3.442	3.679	3.522	3.727	4.750	5.230	3.361	9.059
5	2.759	3.694	4.284	4.680	3.734	10.211	5.262	4.110	11.262**
6	2.769	7.620	4.409	5.625	4.242	10.211	10.582	4.583	12.939**
7	3.143	7.988	5.844	6.380	6.618	10.904	14.252**	5.171	13.148
8	4.645	8.937	5.969	7.072	7.176	12.891	16.463**	7.155	13.157
9	5.373	9.865	7.634	8.128	7.431	15.418	17.484**	7.176	13.244
10	6.604	10.231	7.902	8.332	7.626	15.429	17.864	9.749	13.263
11	7.675	11.015	8.311	9.009	8.741	15.434	20.837**	9.870	13.583
12	7.743	11.717	8.353	12.935	21.134**	22.262**	20.941	9.879	13.585
13	8.413	15.866	10.782	13.517	22.827**	25.571**	21.185	10.265	13.927
14	8.428	16.381	11.658	13.889	23.238	29.480**	21.185	11.074	14.030
15	8.580	18.350	12.104	13.976	23.656	29.480**	25.537**	11.612	14.605
16	9.562	19.751	12.171	14.799	29.070**	29.604**	25.960	13.383	14.751
	ICICIPRULI			YESBANK					
	Daily	Weekly	Monthly	Daily	Weekly	Monthly			
1	3.362	0.000	0.170	2.992	1.814	2.957			
2	3.859	0.167	2.139	3.801	2.713	3.414			
3	3.926	0.260	2.158	11.665*	4.183	3.753			
4	5.168	0.262	3.484	11.690**	8.241	4.079			
5	9.665	1.674	3.871	12.216**	8.616	4.539			
6	9.752	2.208	4.429	12.808**	8.667	4.812			
7	10.437	2.209	4.752	13.763	11.346	5.477			
8	11.341	2.239	5.001	13.803	12.587	5.507			

	ICICIPRULI			YESBANK					
	Daily	Weekly	Monthly	Daily	Weekly	Monthly			
9	11.389	2.571	5.176	13.908	14.137	7.573			
10	11.528	3.762	7.897	16.384	14.257	10.337			
11	11.815	4.320	7.899	17.043	17.449	10.674			
12	12.173	7.792	9.529	17.255	17.476	11.368			
13	12.176	14.846	10.562	17.423	18.355	11.520			
14	12.657	16.188	11.272	18.161	22.795	11.669			
15	12.780	17.433	11.391	18.483	22.907	12.295			
16	12.782	18.968	11.414	18.535	22.911	12.703			

Source: Provided by authors.

The results obtained for the daily series indicate that the Ljung-Box Q-statistic was computed across 16 lags to test the null hypothesis that all auto-correlation coefficients (ρ_k) are zero. Among the listed series, including INFY, TECHM, WIPRO, PERSISTENT, SBIN, LTIM, HCLTECH, LT, AUBANK, CHOLAFIN, ICICIBANK, and ICICIPRULI, none showed significant results at the 5 per cent level across all lag levels. However, specific series, such as TCS, exhibited insignificance from lag 4 to lag 15, while TATACONSUM was insignificant up to lag 2. Notably, the series GAIL demonstrated insignificance up to lag 14, CIPLA showed insignificance across all lags except for lags 7, 8, 9, 11, and 15, and YESBANK exhibited insignificance except for lag 3, 4, 5, and 6. These observations indicate that the auto-correlation values at various lag levels hovered around zero, resembling characteristics of a stationary process. Consequently, based on the findings derived from the ACF and Ljung-Box Q-statistic, it can be inferred that the series conforms to a stationary process and does not adhere to the random walk model.

The results for the weekly series indicate that the Ljung-Box Q-statistic was calculated over 16 lags to examine the null hypothesis that all auto-correlation coefficients (ρ_k) are zero. Among the listed series, including INFY, TECHM, LTIM, TCS, HCLTECH, SBIN, GAIL, CHOLAFIN, CIPLA, ICICIPRULI, and YESBANK, none exhibited significant results at the 5 per cent level across all lag levels. However, specific series, such as PERSISTENT, displayed insignificance at all lag levels except for lags 1, 5, and 6, while TATACONSUM was insignificant only at lag 13. Notably, the series GAIL showed insignificance at all levels except for lags 3, 7, 8, 9, and 10, while AUBANK was insignificant up to lag 9 and at lag 11. Additionally, ICICIBANK exhibited insignificance across all lag levels, except for lags 12, 13, and 16.

These observations indicate that the auto-correlation values at various lag levels hovered around zero, resembling characteristics of a stationary process. Consequently, based on the findings derived from the ACF and Ljung-Box Q-statistic, it can be inferred that the series conforms to a stationary process and does not adhere to the random walk model.

The analysis of the monthly series involved computing the Ljung-Box Q-statistic, which tests the hypothesis that all auto-correlation coefficients (ρ_k) are zero. This computation was conducted over 16 lags. Among the series examined, including INFY, TECHM, TCS, WIPRO, HCLTECH, PERSISTENT, TATACONSUM, SBIN, GAIL, LT, AUBANK, CHOLAFIN, ICICIPRULI, and YESBANK, none displayed significant results at the 5% level across all lag levels. However, the series for LTIM exhibited insignificance at lags 3, 5, 7, 8, 10, and 11. Conversely, ICICIBANK showed significance at lags 12, 13, 14, 15, and 16, while CIPLA displayed insignificance across all lags except for lags 2, 5, and 6.

This examination revealed that the auto-correlation values at various lag levels hovered around zero, indicative of a stationary process. Consequently, based on the findings derived from the ACF and Ljung-Box Q-statistic, it can be inferred that the series conforms to a stationary process and does not adhere to the random walk model.

To enhance the robustness of the findings, the study proceeds to conduct a unit root test to assess the stationarity of the data series. In the context of the EMH, it is imperative for the series to exhibit either a random walk movement or a non-stationary process. The results of the unit root test are presented below, with Table 6 showcasing the outcomes of the Augmented Dickey Fuller (ADF) test, and Table 7 presenting the results of the Philips-Perron test.

Table 6: Results of Augmented Dickey Fuller (ADF) Test

	Daily Return		Weekly Return		Monthly Return	
	t-Statistics	Prob.*	t-statistics	Prob.*	t-Statistics	Prob.*
INFY	-35.034	0.000	-16.050	0.000	-7.655	0.000
TECHM	-34.015	0.000	-16.640	0.000	-7.665	0.000
LTIM	-37.024	0.000	-16.610	0.000	-9.734	0.000
TCS	-32.312	0.000	-16.510	0.000	-9.064	0.000
WIPRO	-3.180	0.021	-16.410	0.000	-8.594	0.000
HCLTECH	-36.249	0.000	-16.300	0.000	-8.186	0.000
PERSISTENT	-34.388	0.000	-18.220	0.000	-8.543	0.000
TATACONSUM	-34.328	0.000	-19.700	0.000	-8.848	0.000
SBIN	-34.362	0.000	-15.990	0.000	-6.961	0.000
GAIL	-36.358	0.000	-15.910	0.000	-7.800	0.000
LT	-34.695	0.000	-14.640	0.000	-7.784	0.000
AUBANK	-33.924	0.000	-15.760	0.000	-9.745	0.000
CHOLAFIN	-33.906	0.000	-16.210	0.000	-8.916	0.000
ICICIBANK	-33.194	0.000	-16.220	0.000	-8.510	0.000
CIPLA	-33.593	0.000	-17.650	0.000	-7.794	0.000
ICICIPRULI	-33.228	0.000	-16.080	0.000	-7.223	0.000
YESBANK	-36.788	0.000	-16.080	0.000	-9.517	0.000

Source: Provided by authors.

*MacKinnon (1996) one-sided p-values.

Table 7: Results of Philips-Perron Test

	Daily Return		Weekly Return		Monthly Return	
	T-Statistics	Prob.*	T-Statistics	Prob.*	T-Statistics	Prob.*
INFY	-35.068	0.000	-16.050	0.000	-9.232	0.000
TECHM	-34.002	0.000	-16.640	0.000	-7.920	0.000
LTIM	-37.040	0.000	-16.690	0.000	-9.828	0.000
TCS	-32.318	0.000	-17.070	0.000	-9.064	0.000
WIPRO	-3.180	0.021	-16.850	0.000	-10.750	0.000
HCLTECH	-36.249	0.000	-16.400	0.000	-8.212	0.000
PERSISTENT	-34.613	0.000	-18.530	0.000	-8.547	0.000
TATACONSUM	-36.228	0.000	-20.300	0.000	-9.271	0.000
SBIN	-34.364	0.000	-15.990	0.000	-6.939	0.000
GAIL	-36.357	0.000	-15.980	0.000	-7.835	0.000
LT	-34.693	0.000	-14.610	0.000	-7.784	0.000
AUBANK	-33.910	0.000	-15.880	0.000	-9.797	0.000
CHOLAFIN	-33.891	0.000	-16.400	0.000	-11.983	0.000
ICICIBANK	-36.188	0.000	-16.230	0.000	-8.476	0.000
CIPLA	-33.648	0.000	-17.610	0.000	-9.056	0.000
ICICIPRULI	-33.187	0.000	-16.090	0.000	-7.218	0.000
YESBANK	-37.510	0.000	-16.090	0.000	-9.517	0.000

*MacKinnon (1996) one sided p-values.

Source: Provided by authors.

Upon testing the null hypothesis of the series having a unit root, both the Augmented Dickey Fuller test and the Philips-Perron test reveal statistical significance at the 5 per cent level for all the series of daily, weekly, and monthly stock returns included in the study. This suggests that the series exhibits no unit root, indicating stationarity and refuting the notion of a random walk.

In summary, the results from the Run Test, Auto-correlation Function, and both Unit Root Tests- Augmented Dickey Fuller and Philips-Perron- statistically affirm that the daily, weekly, and monthly stock return series of the 17 stocks comprising the BSE CARBONEX, with considerable ESG scores, do not adhere to the 'Random Walk Hypothesis' or the EMH. Consequently, all three hypotheses of the study (H1, H2, and H3) are rejected based on the aforementioned findings. These outcomes are consistent with prior research by Poshakwale (1996); Pandey (2003); Khan (2006); Sarkar (2019); and Gurung and Sarkar (2023).

CONCLUSION

In conclusion, this study has conducted a detailed examination of the BSE Carbon Index, focusing on 17 out of its total 30 constituent stocks. Utilising daily, weekly, and monthly data sourced from the BSE spanning a five-year period from January 1, 2015, to December 31, 2019, and employing rigorous statistical analyses such as the Run Test, Auto-correlation Test, and Unit Root Test, it has been revealed that the companies comprising the BSE Carbon Index do not conform to the principles outlined in the 'Random Walk Hypothesis'. Drawing insights from an extensive literature review on the EMH and bolstered by empirical evidence, it is justifiable to conclude that the foundational concept of a random walk and the EMH, initially formulated by Eugene Fama in the 1970s, does not hold true for the BSE Carbon Index within the context of the Indian Stock Market.

The discoveries uncovered in this study hold paramount importance for investors seeking clarity on their investment strategies concerning sustainability initiatives. They illuminate the trends observed in daily, weekly, and monthly stock return movements, providing insights into whether these movements follow a random pattern. Additionally, the research delves into the potential influence of past stock returns on future returns, elucidating through auto-correlation tests and addressing unit root issues.

These findings carry implications that transcend the realm of investors to encompass analysts and stakeholders actively engaged in ESG investing and sustainability endeavors. They lay the groundwork for exploring further avenues of research, urging the utilisation of more

sophisticated statistical methodologies. Moreover, the insights gleaned from this study offer valuable perspectives on the performance of BSE-CARBONEX, structured upon sustainability principles, within the Indian financial landscape. Consequently, they contribute significantly to a more profound comprehension of ESG investing dynamics and sustainability initiatives.

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INFLUENCE OF SERVICE QUALITY OF AIRLINES ON SATISFACTION OF PASSENGERS: A PERCEPTUAL STUDY

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Abstract *The service industry is a significant contributor to the Indian GDP and faces formidable competition in the era of globalisation. The aviation sector, following the liberalisation of the Indian economy, has undergone substantial transformation due to increased competition. To thrive in this industry, it has become crucial to provide high-quality services. Service quality plays a critical role in satisfying customers and fostering customer loyalty towards the organisation. It serves as a yardstick to retain existing customers as well as to attract potential ones. The main objective of the present study is to investigate how the dimensions of service quality influence passenger satisfaction. In order to carry out the study a sample of 250 respondents has been selected. Descriptive statistics, one-way ANOVA, correlation coefficient, and multiple regression techniques have been used to analyse the data and to arrive at the findings of the study. The study reveals that all the dimensions of service quality have positive and significant relationship with the satisfaction of passengers. Further, the study also reveals that out of seven dimensions, only four dimensions, namely, responsiveness, courtesy, empathy, and convenience, have a significant influence on the satisfaction of passengers under consideration.*

Keywords: *Courtesy, Empathy, Reliability, Responsiveness, Convenience*

INTRODUCTION

The service industry plays a significant role in the overall economy throughout the world. Understanding the customers and providing high-quality of service is the strategy that can be used by the service providers to place themselves effectively in the highly competitive market (Parasuraman et al., 1988; Brown & Swartz, 1989; Bitner, Booms & Tetreault, 1990; Cronin & Taylor, 1992). Service quality can be seen as a strategic approach for managing business processes with the aim of improving customer satisfaction. It holds significant importance for the growth and progress of service sector enterprises (Adhikari & Paul, 2016). In the current landscape of intense competition, service quality emerges as a fundamental pillar for businesses striving to secure a market share. Consequently, providing high-quality service has become an indispensable requirement for survival in today's cut-throat market environment (Adhikari & Paul, 2016). In today's highly competitive and dynamic business environment, providing quality services has become essential for businesses. It is no longer just about retaining the existing market share but also about expanding it. To survive in today's competitive and dynamic environment, business organisation need to manage their capabilities to satisfy the consumer and to retain them (Sharma & Sharma,

2021). Companies that offer high-quality services will have a better chance of surviving and thriving in such a competitive marketplace (Adhikari & Paul, 2015). The Indian aviation industry is among the world's fastest growing aviation industry. This growth can be attributed to the significant changes that have taken place following the liberalisation of the aviation industry in India (Subha & Archana, 2013). The success of airline services primarily centres on a range of factors, including the availability of diverse facilities, amenities, pricing structures, efficient ground services, in-flight services, seamless travel experiences and other related aspects (Murugeswari, 2018). Given the growth of the service sector, specifically in the airline industry, it is important for the airline companies to gain a deep understanding of their customers and deliver the desired service to their customers (Pappachan, 2015). Exceptional service not only cultivates loyalty among passengers but also helps in positive word-of-mouth, enhancing the airline's reputation and setting it apart from competitors. Additionally, satisfied passengers are more inclined to recommend the airline, contributing to increased profitability and revenue. Despite extensive research in larger markets, the application of these principles in smaller towns like Silchar has received limited attention. Existing studies on service quality and passenger satisfaction predominantly focus on major urban centres, leaving a significant gap in

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understanding the dynamics of smaller towns environments such as Silchar. Therefore, this study aims to explore the crucial relationship between service quality and passenger satisfaction in Silchar town of Assam.

CONCEPTUAL FRAMEWORK AND REVIEW OF LITERATURE

Service quality refers to an overall evaluation of the effectiveness and performance of services provided by a service provider (Parasuraman et al., 1988). The significance of quality in services and goods is increasingly acknowledged as a strategic factor for enhancing efficiency and effectiveness in business operations. As the importance of quality continues to be acknowledged, efforts in the services marketing area have increased to improve the quality of services (Anderson & Zeithaml, 1984; Babakus & Boller, 1992). It is crucial because it has an immediate impact on customer satisfaction, brand loyalty and the long-term success of companies across a range of industries, including banking, retail, and aviation (Chhabra, 2018; Faria et al., 2022). Perceived service quality refers to how well a company fulfils its customers' expectations and meets their needs (Adhikari & Paul, 2016). Ensuring high service quality is crucial for organisations to gain a competitive advantage in the market and create a long-term customer relationship (Zeithaml et al., 1990; Lam et al., 2004). The competitive advantage of a company is influenced by service quality, which plays a crucial role in maintaining customer loyalty and thereby increasing market share. Ensuring the provision of quality services is imperative for the growth of the business of airlines (Agarwal, 2020). Customer satisfaction can be defined as a post-purchase evaluative judgment and overall attitude, encompassing an emotional response that arises from the difference between customers' expectations and their actual experience with a specific product or service (Zeithaml & Bitner 1996; Oliver 1999; Westbrook & Oliver, 1991; Kotler et al., 2006). Measuring customer satisfaction is an important element for the new company as it can play a significant role in its performance (Tsafarakis et al., 2018). Customers satisfaction is an important aspect of any business organisation because to thrive and generate profits, it must effectively meet the needs of its customers (Shin & Elliott, 2001). This is primarily due to the strong association between customer satisfaction and repurchase intentions (Cronin & Taylor, 1992). Customer satisfaction is a critical concept in marketing and represents the ultimate objective for service operations. It is widely believed that there is a strong association between satisfaction of customers and consumer behaviour (Park et al., 2006). Positive perception and providing high-quality service can contribute to passengers' satisfaction and loyalty while negative perception can be

detrimental for the airline company and it can hamper the business of the airline company.

Baby (2014) has classified airline service quality factors into three stages (pre-flight, in-flight and post-flight) services and findings showed that passengers have higher expectations in all those three stages of service. Ganiyu (2016) found that perceived service quality has an impact on satisfaction of passengers, and thus, loyalty to the airlines. Sanyal and Hisam (2016) observed that overall service quality is highly related to both satisfaction of passengers and preferences. Subha and Archana (2013) found that the 'assurance' dimension was most important dimension followed by empathy, responsiveness, reliability, and tangibility. Passengers placed a high level of importance on the trustworthiness of front office personnel, as they bear the crucial responsibility for ensuring the productivity and smooth operation of the entire airline process. Wickramaratne and Karunaratna (2018) found that various service quality dimensions have a positive effect on passengers' satisfaction. Dolekoglu et al. (2016) found that passengers gave more attention to employee's competence and hence they perceived that reliable and adequate staff is the most significant aspect of service quality. Thapa et al. (2020) found that the factor that influences most in the selection of airlines is the security they assure and timely flights. Suresh et al. (2017) found the majority of respondents considered responsiveness to be the most significant dimension of service quality, followed by tangibility, empathy, assurance, and reliability. Ali et al. (2015), found service quality was influenced by all five dimensions of service quality present in the AIRQUAL Model. Mohideen and Rajak (2016) found that, according to passengers' perceptions, staff uniforms and appearance, food options, promptly receiving boarding passes, and awareness and knowledge to answer travellers' questions were the key factors influencing service quality in the airline industry. Singaravelu and Amuthanayaki (2017) revealed that foods provided, comfortable seats and safety were the dominant dimensions in in-flight service quality. Additionally, online ticket booking emerges as a significant dimension in the realm of back-office operations. Gilbert and Wong (2003) found that passengers rated "assurance" as the most significant dimension of service quality. This finding suggested that passengers prioritise safety and security features when evaluating the quality of service. Khraim (2013) found airline image as the most important dimension affecting customer behavioural intentions. Geraldine and Chikwendu (2013) opined that there was a positive correlation between the quality of service and the airline image. Additionally, the airline image was found to have a positive association with passengers' repeat patronage.

The literature review highlights the significant focus on service quality by researchers in India and abroad, with

numerous studies conducted worldwide. Not a single worthy literature has been found on the service quality of domestic airlines in the Northeast India Region. The need for research arises as there is no significant study carried out on service quality of airlines in the context of Silchar town of Assam located in Northeast India. Various researchers have employed different dimensions to

assess service quality. However, it is noteworthy that the SERVQUAL Model developed by Parasuraman, Zeithaml, and Berry in 1988 remains relevant even in the current era. In the present study, seven service quality dimensions have been used, namely Reliability, Responsiveness, Courtesy, Competence, Tangibility, Empathy and Convenience (Table 1).

Table 1: Select Service Quality Dimensions

Service Quality Dimensions	Author and Year
Reliability	Chen and Liu (2017); Gilbert and Wong (2003); Abdullah and et al. (2007)
Tangibility	Chikwendu and Ezenwa (2012); Thapa et al. (2020); and Nedunchezhian and Thirunavukkarasu (2018),
Responsiveness	Shanka (2012); Khraim (2013); Mahmud and et al. (2013); and Baker (2013)
Courtesy	Namukasa (2013); Yeh and Kuo 2003; Tsaaur, Chang and Yen (2002)
Competence	Selnes (1998); Singh, Kumar and Kumar (2019); Singh and Mujoo (2022)
Empathy	Lerrthairakul and Panjakajornsak (2014); Martey and Frempong (2014); Dolekoglu and et al. (2016)
Convenience	Geraldine and Chikwendu (2013); Yeh and Kuo (2003); Park, Robertson and Wu (2006)

Source: Extracted from review of literature.

OBJECTIVES OF THE RESEARCH WORK

- To study the perception of passengers of Silchar town of Assam about the service quality of airlines.
- To compare the perception of passengers about the service quality of different airlines operating from Silchar, Assam.
- To analyse the influence of service quality of airlines on satisfaction level of passengers of Silchar town of Assam.

HYPOTHESES OF THE RESEARCH WORK

- There exists no significant variation in the perception of passengers about select dimensions of service quality across different airlines.
- There exists no significant correlation between select dimensions of service quality of airlines and passengers' satisfaction.
- There exists no significant influence of select dimensions of service quality of airlines on passengers' satisfaction.

METHODOLOGY OF THE RESEARCH WORK

The study considers primary data as the basis for its analysis. Data have been collected from the respondents of Silchar

town who have travelled from Silchar Airport. In order to conduct the survey various dimensions of service quality has been identified through an extensive review of literature. The current study involved a sample of 250 respondents who have been given a structured questionnaire. The field survey has been conducted from July 2023 to February 2024, which may be considered as the reference period of the survey (Table 2).

Table 2: Airline Wise Distribution of Respondents

Airline Company	Frequency	Percent
Air India	75	30.0
Indigo	99	39.6
SpiceJet	76	30.4

Source: Field survey.

The questionnaire consists of seven service quality dimensions, rated on a scale from 1 (=strongly disagree) to 7 (=strongly agree). Participants have been requested to indicate their level of agreement or disagreement with each dimension. Descriptive statistics, one-way ANOVA, correlation and multiple regression analysis have been used as statistical tools to analyse the data and draw conclusions from the study.

SCOPE OF THE RESEARCH WORK

- The present study specifically targets passengers who have travelled from Silchar Airport, limiting the scope of the research to this particular group.
- The measurement of service quality in this study is based solely on seven dimensions of service quality.

LIMITATIONS OF THE RESEARCH WORK

- The research is inherently constrained by the limitations typically associated with the perception based study.
- It is impossible to completely eradicate the potential for the sampling error in the study.
- The study is based on the perceptions of 250 respondents and so the result should be interpreted with great caution for making any kind of generalisation.

RESULTS AND DISCUSSIONS

Table 3 depicts the mean and standard deviation of the different service quality dimensions. Among all the seven dimensions, the competence dimension received the highest mean score with 5.01, followed by courtesy with a mean score of 4.94. These findings suggest that these dimensions play a crucial role in improving the service quality. Conversely, convenience receives the lowest average score of 4.47. However, it is important to highlight that empathy dimension exhibits the highest SD of 1.164, indicating greater variability in the responses. On the other

hand, courtesy demonstrates the lowest standard deviation of 1.058, indicating a lower level of inconsistency in the responses for this particular dimension.

Table 3: Perception of Passengers on Select Dimensions of Service Quality

Dimensions	Mean	Std. Deviation
Reliability	4.93	1.089
Tangibility	4.87	1.062
Responsiveness	4.87	1.148
Courtesy	4.94	1.058
Competence	5.01	1.098
Empathy	4.74	1.164
Convenience	4.47	1.130
Passengers' Satisfaction	4.92	1.110

Source: Field survey.

Table 4 illustrates the value of mean and SD of airline wise perceptions of passengers about the service quality of airlines. It has been seen that in all the dimensions, Air India has received the highest mean score, followed by Indigo and SpiceJet. One-way ANOVA has been employed to test the hypothesis if the perception of passengers on different dimensions varies across different airlines.

Table 4: Airline Wise Perception of Passengers on Service Quality Dimensions

Dimensions	Airline	Mean	Std. Deviation	F Value	p Value
Reliability	Air India	5.41	0.917	31.552	0.000
	Indigo	5.12	0.792		
	SpiceJet	4.21	1.219		
Tangibility	Air India	5.21	0.965	17.052	0.000
	Indigo	5.03	0.824		
	SpiceJet	4.32	1.219		
Responsiveness	Air India	5.24	1.106	13.887	0.000
	Indigo	5.00	0.893		
	SpiceJet	4.34	1.296		
Courtesy	Air India	5.31	0.983	18.881	0.000
	Indigo	5.10	0.908		
	SpiceJet	4.37	1.093		
Competence	Air India	5.32	1.136	11.457	0.000
	Indigo	5.12	0.841		
	SpiceJet	4.54	1.211		
Empathy	Air India	5.04	1.280	8.218	0.000
	Indigo	4.83	0.931		
	SpiceJet	4.32	1.211		
Convenience	Air India	4.73	1.060	11.434	0.000
	Indigo	4.65	1.000		
	SpiceJet	3.97	1.200		

Source: Field survey.

Table 4 clearly depicts that all the dimensions have a significant p value, as the p value is less than 0.05, which implies that the perception of passengers about the service quality of airlines varies significantly across different airlines.

Table 5: Satisfaction of Passengers across Different Airlines

Airlines	Mean	Std. Deviation	F Value	p Value
Air India	5.35	1.059	19.493	0.000
Indigo	5.05	0.860		
SpiceJet	4.33	1.208		

Source: Field survey.

Table 5 illustrates the value of the mean and SD of airline wise satisfaction level of passengers. The result shows that passengers are more satisfied with the services of Air India followed by Indigo and SpiceJet. One-way ANOVA has been employed to test whether there exists any significant difference in responses of passengers among different airlines. The result showed that satisfaction of passengers among airlines across airlines varies significantly.

Table 7: Result of Multiple Regression Analysis

Model		Unstandardised Coefficients		Standardised Coefficients	t Value	p Value
		B	Std. Error	Beta		
1	(Constant)	-.018	0.170		-.106	0.915
	Reliability	0.096	0.055	0.095	1.755	0.080
	Tangibility	0.081	0.057	0.077	1.423	0.156
	Responsiveness	0.120	0.055	0.124	2.204	0.028
	Courtesy	0.224	0.058	0.213	3.843	0.000
	Competence	0.105	0.057	0.104	1.833	0.068
	Empathy	0.268	0.049	0.281	5.505	0.000
	Convenience	0.130	0.041	0.132	3.153	0.002
R ² = 0. 793; Adjusted R ² = 0. 787; F Value = 132.810; p Value = 0.000						

Note: Dependent Variable = Passengers’ Satisfaction.

Source: Field survey.

The R² value presented in the Table 7 indicates that approximately 79.30% of the variance in passengers’ satisfaction levels can be accounted for by the explanatory variables utilised in the study. Similarly, the adjusted R² value signifies that 78.7% of the variation in passengers’ satisfaction levels can be elucidated by the chosen predictors, i.e., the seven service quality dimensions. Consequently, the selected service quality dimensions exhibit a substantial capability to explain a significant portion of the variation

Table 6: Correlation between Service Quality Dimensions and Satisfaction of Passengers

Dimensions	Correlation Coefficient	p Value
Reliability	0.743	0.000
Tangibility	0.747	0.000
Responsiveness	0.780	0.000
Courtesy	0.798	0.000
Competence	0.784	0.000
Empathy	0.801	0.000
Convenience	0.692	0.000

Source: Field survey.

Table 6 reveals the correlation between select service quality dimensions and passenger satisfaction. Notably, all the dimensions demonstrate a positive relationship with passengers’ satisfaction. Among the dimensions, empathy exhibits the highest degree of correlation (0.801) with passenger satisfaction, followed by courtesy (0. 798), competence (0. 784), responsiveness (0.780), Tangibility (0. 747), reliability (0.743) and convenience (0.692). The p-values associated with each dimension indicate statistically significant correlations between all the dimensions and satisfaction of passengers.

observed in the satisfaction levels of passengers of Silchar. The high significance of the regression model is indicated by the F-statistic of 132.810, along with a p-value of 0.000. The findings suggest that the data effectively demonstrate the influence of the selected service quality dimensions on the satisfaction of passengers. Hence, the overall predictability of the model is favourable, indicating its ability to provide valuable insights and explanations regarding passenger satisfaction.

The data presented in the Table 7 demonstrates that each of the selected service quality dimensions has a positive impact on customer satisfaction in the studied context. This is evident from the positive b values associated with all seven predictors. Notably, the empathy dimension has the strongest influence on customer satisfaction when compared to the other dimensions, assuming the effects of the remaining dimensions are constant. Conversely, the tangibility dimension has the lowest influence on customer satisfaction among the seven predictors, as indicated by the data presented in the Table 7. Based on the corresponding t-values and p-values, it is evident that four out of the seven predictors, namely responsiveness, courtesy, empathy and convenience make a noteworthy and statistically significant contribution to the model, with a significance level of 5%.

Table 8: Collinearity Statistics

Dimensions	Tolerance	VIF
Reliability	0.294	3.402
Tangibility	0.289	3.459
Responsiveness	0.268	3.733
Courtesy	0.277	3.613
Competence	0.267	3.751
Empathy	0.326	3.063
Convenience	0.485	2.063

Source: Field survey.

The study aims to assess the individual impact of dimensions of service quality (independent variables) on passenger satisfaction by addressing the issue of multicollinearity. This analysis employs measures such as the Variance Inflation Factor (VIF) and tolerance value to assess the extent of multicollinearity. The results are presented in Table 8. It is widely recognised that a VIF value exceeding ten (10) is a common indicator of multicollinearity (Mason et al., 1989). In this study, the absence of multicollinearity is supported by the Variance Inflation Factor (VIF) values, which range from 2.063 to 3.751. The tolerance values for the explanatory variables in the regression model range from 0.267 to 0.485, all of which exceed 0.10. This indicates the absence of multicollinearity, as recommended by research.

SUMMARY OF MAJOR FINDINGS

- The mean score of select service quality dimensions indicates that the perceptions of passengers about the service quality of airlines operating from Silchar Airport are by and large favourable. Passengers have recorded the most favourable perception with respect to the competence dimension followed by courtesy, reliability, tangibility, responsiveness, empathy, and

convenience. Least variation in passengers’ perception has been observed with respect to the courtesy dimension while the highest variation has been noticed in case of empathy dimension.

- The results of one-way ANOVA reveal that passengers’ perceptions over all the seven dimensions of service quality vary significantly across the airlines.
- All the service quality dimensions are positively correlated with passengers’ satisfaction.
- Multiple regression analysis reveals that all dimensions positively influence passenger satisfaction. Specifically, responsiveness, courtesy, empathy, and convenience are the four dimensions of service quality that have a statistically significant impact on passengers’ satisfaction.

CONCLUSION AND IMPLICATIONS

In today’s consumer landscape, customers are increasingly conscious of quality, making the need for better service quality crucial. Providing high-quality service is the key to outperforming competitors and achieving success. Therefore, service quality serves as a vital tool for businesses to sustain themselves in the long term. The present study stresses the importance of service quality, which directly impacts passengers’ satisfaction. The study reveals that out of the seven service quality dimensions, responsiveness, courtesy, empathy, and convenience, have a significant influence on passenger satisfaction. However, the dimensions of Reliability, Tangibility and Competence are found to be statistically insignificant, suggesting that these dimensions do not play a significant role in influencing passenger satisfaction. Findings of the study suggest that the management needs to take every dimension of service quality seriously. Corrective measures can be taken in the dimensions that exhibit weaknesses in meeting customer expectations. Moreover, measurement of service quality should be on a continuous basis to ensure the best quality. Airlines officials should take these evaluations seriously to enhance service quality, thereby increasing passenger satisfaction and confidence. To enhance the experience of the passengers, the airline company should provide additional training to front-line staffs, enhancing their skills and knowledge to ensure fast and reliable service. Additionally, upgrading the physical aspects is also necessary to enhance the experience of the passengers.

SCOPE FOR FUTURE RESEARCH

A similar study with a larger and more diverse sample could be conducted to ensure that the findings can be applied to a broader population.

In addition to those seven dimensions of service quality, more dimensions can be identified to measure the association between those dimensions and the satisfaction of the passengers.

A comparative study can be conducted to evaluate and compare the performance of different airlines. This analysis can provide valuable insights for policy-making and offer opportunities for enhancing guidelines and strategies within the industry.

In the future, researchers may also conduct similar types of studies using different statistical tools, like factor analysis or other techniques for multivariate data analysis.

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TRADE LIBERALISATION AND POVERTY REDUCTION: A SYSTEMATIC LITERATURE REVIEW

Komal Chhikara*

Abstract *This study explores the relationship between trade liberalisation and poverty reduction in developing countries. Advocates argue that increased trade liberalisation can drive economic growth, create employment opportunities, and improve living standards for the poor. However, critics express concerns about potential negative consequences, such as increased income inequality and job losses. The study aims to answer three key questions: 1) To what extent does trade liberalisation contribute to poverty reduction? 2) What are the specific channels through which trade liberalisation influences poverty reduction? 3) What are the differential impacts across regions and countries? Analysing 86 empirical studies from 2001 to 2022, this paper conducts a systematic literature review using the PRISMA methodology. Findings reveal a nuanced relationship between trade liberalisation and poverty reduction, identifying channels such as economic growth, employment effects, increased exports, enhanced productivity, and income level impacts. The differential impacts across diverse regions, including Africa, Asia, and South America, underscore the need for tailored, context-specific policies considering specific circumstances, economic structures, and governance factors. The findings contribute to ongoing policy debates, guiding policymakers toward inclusive strategies for sustainable poverty reduction in developing countries.*

Keywords: *Trade Liberalisation, Poverty Reduction, Economic Development, International Trade, Income Inequality*

INTRODUCTION

The relationship between trade and poverty has been the subject of extensive discussion, particularly in the context of developing countries. Advocates of trade liberalisation assert that increased openness to trade can drive economic growth, resulting in poverty reduction. They argue that by expanding market access, promoting exports, and attracting foreign investment, trade liberalisation can create employment opportunities, enhance productivity, and improve living standards for the poor.

On the other hand, critics raise concerns about the potential negative consequences of trade liberalisation on poverty. They contend that the benefits of trade may not reach the most vulnerable segments of society, leading to increased income inequality (Goldberg & Pavcnik, 2004; Wu, Jabbar, Naeem, Huaping & Jingyu, 2019). Furthermore, they argue that in certain cases, trade liberalisation can perpetuate or even worsen poverty by undermining local industries, causing job losses, and exacerbating dependence on volatile international markets (Castilho, Marta & Aude, 2012; McCaig, 2011; Niimi, Puja & Alan, 2007; Topalova, 2010; Winters, McCulloch & McKay, 2004). The debate surrounding the relationship between trade and poverty

highlights the need for careful analysis and comprehensive policies to ensure that the potential benefits of trade are equitably distributed and contribute to sustainable poverty reduction.

This paper contributes to the existing literature by systematically examining research articles that investigate the impact of international trade and trade liberalisation policies on reducing poverty. By synthesising and evaluating the existing literature of the past two decades (2001–2022), this review aims to shed light on the various dimensions and mechanisms through which trade liberalisation can affect poverty levels in developing countries. Through the rigorous application of predefined inclusion criteria and systematic data analysis, this study aims to provide policymakers and researchers with a comprehensive overview of the existing evidence, identify gaps in the literature, and offer recommendations for future research directions.

OBJECTIVES

- To organise and synthesise empirical knowledge regarding the relationship between poverty and international trade, focusing on three primary questions:

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- To what extent does trade liberalisation contribute to poverty reduction in developing countries?
- What are the specific channels through which trade liberalisation influences poverty reduction?
- What are the differential impacts of trade liberalisation on poverty reduction across different regions and countries?

We begin by revising studies that address the causal effect of increasing international trade on poverty. The rest of the paper is structured as follows: Section 2 presents the methodology used to select the papers that identify causal effects. Section 3 revises the main outcomes of the papers selected in each of the three categories, and, finally, Section 4 discusses and summarises the findings.

METHODOLOGY

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology is widely recognised and accepted for conducting and reporting systematic reviews across various domains (Moher et al., 2009). In this systematic review, the PRISMA approach was employed. To retrieve relevant articles, eight databases were selected, covering publications from 2001 to 2022. The search terms and filters applied for each of the databases are detailed in Table 1. The study identification, screening, eligibility, and inclusion processes were carried out following the PRISMA methodology, as depicted in Fig. 1.

Journal Selection Criteria

We examined articles featured in reputable journals that specifically delved into the impact of Trade Openness/Trade Liberalisation on Poverty Reduction/Poverty Alleviation. Our research scope was limited to empirical studies published in esteemed journals that concentrated on developing countries. We prioritised papers that sought to investigate the causal link between trade and poverty during the timeframe spanning from 2001 to 2022. By focusing on this specific timeframe, the study aims to capture the most recent and relevant studies in the field, taking into account the evolving nature of trade policies and their effects on poverty over time. We did not determine a priori whether the studies would have a macro or microfocus, as long as they met the criteria discussed above.

Search Engine

To address the concept of trade-poverty relationship, we accessed articles from prominent electronic databases:

Web of Science, SCOPUS, SpringerLink Journals, SAGE Journals, JSTOR, Emerald, ScienceDirect, and Taylor & Francis, which contain prominent journals on development economics, were searched both manually and through a computerised process. Our search process involved utilising a combination of keywords present in the title, abstract, or keywords section of the articles. We employed the “topic” option during keyword searches, which provided us with papers that included the specified terms in their title, abstract, author keywords, and Keywords Plus. Initially, we focused on searching for relevant terms. Subsequently, we refined the results by considering the titles of the papers. Finally, we selected the papers by evaluating their abstracts to ensure they met all our criteria. As a result, this review encompasses a total of 86 research papers.

Screening

The initial screening of article titles and abstracts led to the retention of 905 articles (Table 2).

Some papers (487) of these were rejected because of the following reasons: i) books, review papers, letters, and replies; ii) non-empirical papers; iii) not including words like trade liberalisation, poverty eradication, poverty reduction, and trade openness; and iv) papers did not investigate the relationship between trade and poverty. Further, (418) Full-text articles were assessed for eligibility and (332) papers were further excluded.

Table 1: Search Terms

Database	Keywords
Web of Science, SCOPUS, SpringerLink Journals, SAGE Journals, JSTOR, Emerald, ScienceDirect, and Taylor & Francis	1) Poverty OR poor 2) Poverty Reduction OR poverty alleviation OR poverty eradication OR poverty mitigation 3) International Trade OR global trade or foreign trade 4) Trade Liberalisation OR trade openness OR trade reform

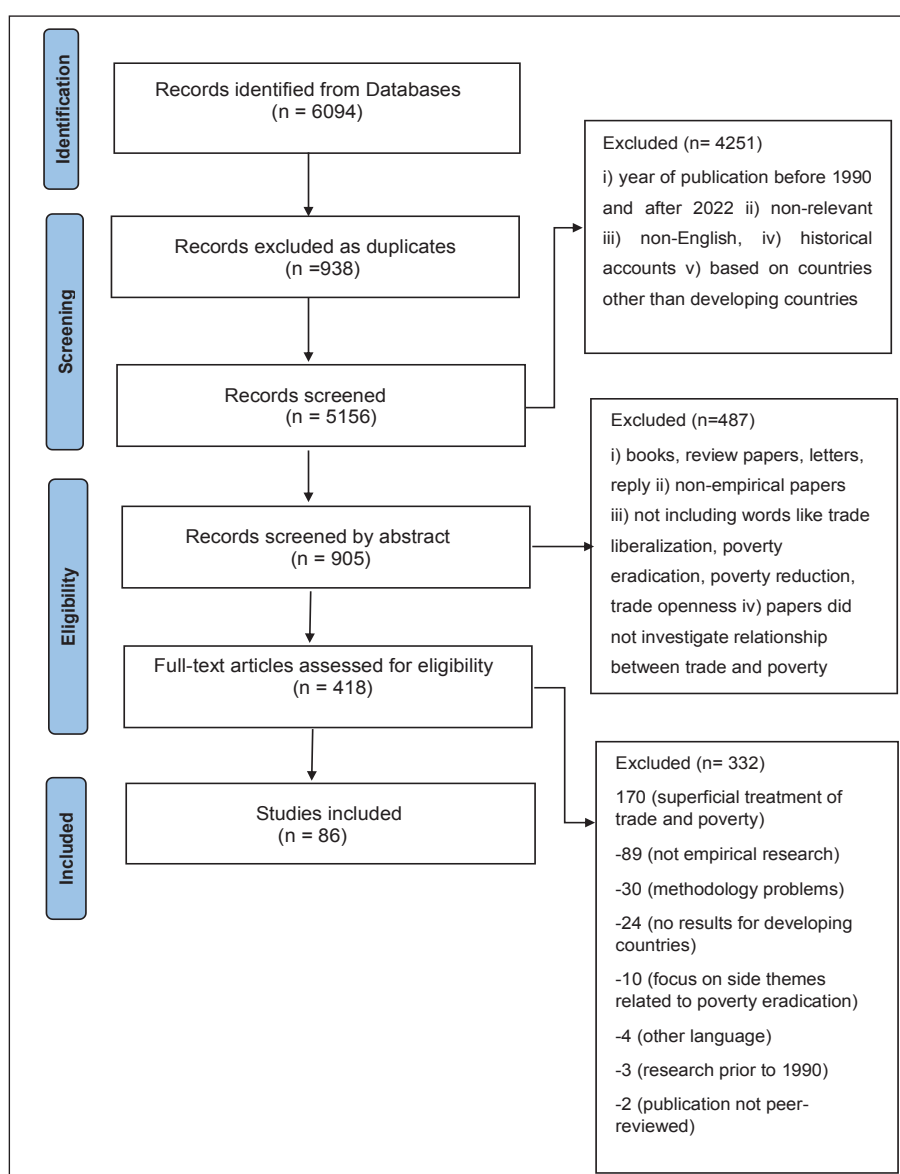
Source: Author’s compilation.

Out of these, (170) papers were excluded for superficial treatment of trade and poverty. Further, (89) were not empirical research, (30) papers had methodology problems, (24) papers had no results for developing countries, (10) papers focused on side themes related to poverty eradication, (4) papers were in other languages, (3) research papers belonged to the period prior to 1990 and finally, (2) publications were not peer-reviewed. Mainly (86) articles were therefore retained for a full review. After selecting the 86 papers, we read the papers and categorised the papers according to the three themes addressed in the literature review.

Table 2: Inclusion and Exclusion Criteria

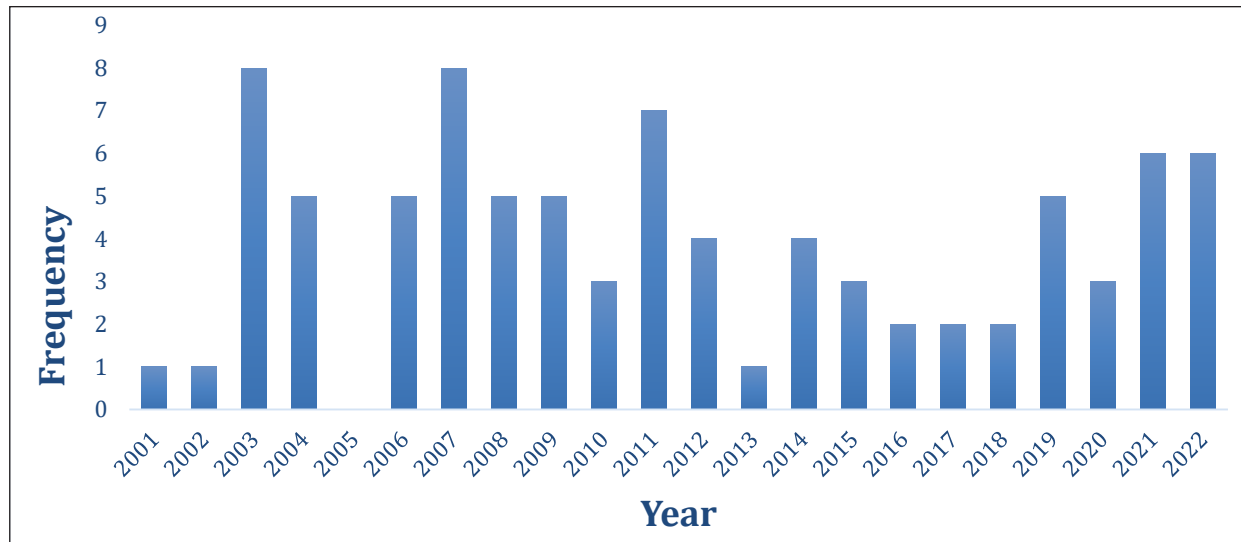
Elements	Inclusion	Exclusion
Type of Literature	Journal research articles	Review articles, book chapters, conference papers, letters and replies, editorial
Language	English	Other languages except for English
Time period	2001–2022	Before 2001 and after 2022
Country	Developing countries	High-income countries
Title and Abstract	Impact of International Trade on poverty reduction	Papers not focusing on the impact of international trade on poverty reduction
Full-text screening	Objective: Impact of International trade on poverty reduction	Not satisfying objective

Source: Author's compilation.



Source: Author.

Fig. 1: Prisma Flowchart



Source: Author's compilation.

Fig. 2: Year-Wise Number of Papers Published

DISCUSSION

The analysis of 86 papers on the relationship between trade and poverty provides a comprehensive understanding of the challenges, opportunities, and outcomes associated with trade liberalisation and its impact on poverty reduction. The diverse range of countries and regions covered in the analysis reveals the nuanced effects of trade policies on poverty levels across different economic contexts. By examining the methodologies, findings, and insights presented in these papers, a more comprehensive understanding of the trade-poverty nexus emerges. The implications of these articles for the questions that guide this work are discussed below:

To what extent does trade liberalisation contribute to poverty reduction in developing countries?

Trade liberalisation has been extensively studied in relation to its impact on poverty reduction, revealing a complex and nuanced relationship. Table 3 provides a detailed discussion of the extent to which trade liberalisation contributes to poverty reduction in developing countries, highlighting the varied impacts observed across different studies. Out of the analysed studies, 39 studies support the positive impact of trade on poverty reduction, 17 studies have mixed findings, and 6 studies indicate a negative relationship between trade and poverty. 24 studies aimed to analyse existing theories, review literature, and develop conceptual frameworks related to trade and poverty; hence they did not provide empirical evidence or conclusive findings regarding the positive or negative impact of trade on poverty reduction.

Some notable findings include a positive relationship between foreign direct investment (FDI) and the Human Development Index (HDI), as well as a negative relationship between exchange rates and trade openness with poverty levels (Onakoya et al., 2019). Barraud and Calfat (2008) found that trade liberalisation reduced poverty, particularly benefiting households linked to non-tradable sectors. Wang and Hu (2018) supported these findings, stating that trade liberalisation reduced the poverty probability for rural residents and promoted income growth through mechanisms such as economic growth and financial expenditure. Strutt et al. (2010) highlighted that the complete removal of intra-ASEAN tariffs led to significant poverty reduction, especially benefiting agricultural and rural diversified households. Hertel et al. (2003) found that the poverty headcount decreased for all earnings strata in the long run, indicating the long-term benefits of trade for poverty reduction. Liang (2007) highlighted the mixed effects of trade liberalisation on poverty, with changes in staple food crop prices and access to credit and schools increasing the probability of escaping poverty. Gnanon (2019) suggested that multilateral trade liberalisation is favourable for poverty reduction in developing countries.

Pant and Dhamija (2021) found that trade openness positively influences per capita income levels and leads to poverty reduction in India. Hari Prasad and Bhavani Prasad (2018) found that India's foreign trade increased more significantly in the post-liberalisation period compared to the pre-liberalisation period. This consistent rise in the volume of trade and GDP demonstrates the long-term economic

benefits of trade liberalization, thereby reinforcing the notion that liberalised trade policies can significantly contribute to poverty alleviation.

However, the impact of trade on poverty is not always straightforward. For instance, Rahman and Fang (2020) found that full tariff withdrawal from food imports had a modest impact on poverty reduction, with potential income loss for labourers and food sellers. The effects of trade liberalisation also vary across regions and sectors. While trade liberalisation contributed to poverty and inequality reduction in rural areas, its effects in urban areas were mixed (Castilho et al., 2012). Overall, the relationship between trade liberalisation and poverty is complex and depends on various factors such as regional heterogeneity, agricultural tradability, and multidimensional poverty reduction strategies (Hertel et al., 2003; Wang & Hu, 2018; Wang et al., 2022). The empirical analysis suggests that multilateral trade liberalisation is generally favourable for poverty reduction in developing countries (Gnangnon, 2019). However, it is important to note that the relationship between trade liberalisation and poverty can vary depending on the country, methodology, and specific trade variables (Jeong-Soo & Kyophilavong, 2015). These studies contribute to a deeper understanding of the complex dynamics between trade liberalisation and poverty, providing insights for policymakers aiming to design inclusive and effective poverty alleviation strategies.

While the negative impact of trade liberalisation on poverty reduction is less prevalent in the literature, certain contexts have shown adverse effects. Mohamed (2011) emphasised that trade liberalisation and market-oriented policies may worsen food security, employment rates, and aggravate absolute poverty, stressing the importance of proper tax policies and macroeconomic stability. Van der Westhuizen (2007) noted that trade liberalisation in the clothing industry in South Africa resulted in increased poverty, employment losses, and social dislocation, particularly affecting predominantly female workers. Sindu et al. (2016) found that trade liberalisation had a negative short-run effect on Ethiopia's overall economy, increasing poverty levels, particularly among entrepreneur households.

What are the specific channels through which trade liberalisation influences poverty reduction?

The literature review analysed the specific channels through which trade liberalisation influences poverty reduction. Table 4 provides a detailed discussion of the specific channels through which trade liberalisation influences poverty reduction, highlighting the varied impacts observed across different studies.

One significant channel is economic growth. Several studies have examined the relationship between trade, growth,

and poverty, providing valuable insights into the potential effects of trade on poverty reduction. Buffie and Atolia (2012) explored the relationship between trade, growth, and poverty in Zambia, using a dynamic general equilibrium model, providing insights into the potential effects of trade on poverty reduction. Coxhead and Jayasuriya (2004) examined the implications of trade liberalisation for poverty and the environment in the Philippines, emphasising the importance of development strategies in achieving positive outcomes. Dollar and Kraay (2004) conducted a comprehensive study on trade, growth, and poverty, highlighting the potential benefits of trade openness for poverty reduction. Duncan and Quang (2003) investigated the impact of trade liberalisation on economic growth and poverty reduction strategies, offering valuable insights into the relationship between trade and poverty reduction. Fauzel (2022) examined the impact of trade on poverty reduction in a small island economy, shedding light on the specific challenges and opportunities in such contexts. Gnangnon (2019) explored the role of multilateral trade liberalisation in reducing poverty in developing countries, contributing to understanding the poverty-reducing effects of global trade integration.

Studies have also focused on the employment effects of trade liberalisation on poverty. Fane (2006) explored the impact of trade liberalisation and economic reform on poverty reduction in Lao PDR, emphasising the importance of employment creation in poverty reduction strategies. Lemi (2012) analysed the links between trade liberalisation and changes in poverty status in rural Ethiopia, highlighting the role of increased employment opportunities in poverty reduction. Ocran and Adjasi (2009) conducted a study in Ghana, using household surveys to examine the impact of trade liberalisation on poverty, finding that increased employment opportunities in the export sector contributed to poverty reduction. Nahidi and Seif (2012) investigated the long-run and short-run dynamics between explanatory factors such as labour, fixed capital, trade openness, and manufacturing value added in Iran from 1961 to 2006. The findings revealed a significant and positive impact of trade openness on Iran's manufacturing value added, both in the short term and the long term. Furthermore, the study underscored the crucial influence of labour and capital variables on manufacturing value added, emphasising their importance in shaping Iran's economic landscape over the study period.

Furthermore, the role of increased exports in poverty reduction has been examined. Santos-Paulino (2017) estimated the impact of trade specialisation and trade policy on poverty in developing countries, emphasising the positive relationship between export-oriented trade policies and poverty reduction. Modeste (2019) conducted a study in

Guyana, using cointegration analysis to examine the impact of trade liberalisation on export supply and poverty, finding that increased exports resulting from trade liberalisation had a positive impact on poverty reduction in Guyana.

Another channel is increased productivity. Research by Filipescu (2008), Durongkavoroj and Ryu (2019), Hall (2006), Harrison et al. (2003), and others suggested that trade liberalisation can stimulate productivity growth by promoting technological spillovers, efficiency gains, and innovation. Higher productivity can lead to increased incomes and improved livelihoods, thus reducing poverty.

Trade liberalisation can also affect wages and income levels. Studies by Dunne and Edwards (2007), Heo and Doanh (2009), Hertel et al. (2004), Kis-Katos and Sparrow (2015), Perera et al. (2014), and Ural et al. (2007) explored the link between trade liberalisation and improved wages. They highlight that trade liberalisation can lead to higher wages, particularly in sectors that benefit from increased competitiveness and productivity.

Access to cheaper imports is another channel through which trade liberalisation can impact poverty reduction. Studies by Castilho et al. (2012), Edwards and Stern (2007), Nahar and Siriwardana (2009), and Herault (2007) emphasised that trade liberalisation can lead to lower prices for imported goods, which benefits consumers, particularly low-income households. Access to cheaper imports can improve purchasing power and reduce the cost of living, thereby alleviating poverty.

Foreign Direct Investment (FDI) plays a role in poverty reduction as well. Research by Hertel et al. (2003), Huang et al. (2007), and Wang et al. (2022) examined the link between FDI, trade liberalisation, and poverty reduction. They suggest that FDI inflows, stimulated by trade liberalisation, can contribute to economic development, job creation, technology transfer, and poverty reduction.

Government regulations and policies are critical in shaping the impact of trade liberalisation on poverty reduction. Studies by Chishti and Malik (2001), Cororaton and Cockburn (2007), Fambeu (2021), Mohamed (2011), and Ul-Haq et al. (2022) analysed the role of government regulations in ensuring that the benefits of trade liberalisation are equitably distributed. Effective regulations and policies can help protect vulnerable groups, address market failures, and create an enabling environment for poverty reduction.

Increased competition resulting from trade liberalisation can also contribute to poverty reduction. Ghazanfar et al. (2021) and Onakoya et al. (2019) examined the relationship between trade liberalisation, competition, and poverty reduction. They argue that increased competition can lead to improved efficiency, innovation, and consumer welfare, which can benefit low-income individuals and reduce poverty.

Technological spillovers were highlighted as a channel connecting trade liberalisation and poverty reduction. Studies by Fleming et al. (2010), Liang (2007), and Mohamed (2011) explored how trade liberalisation can facilitate knowledge and technology transfer, leading to productivity gains, innovation, and poverty reduction.

This section highlights the significance of examining multiple channels through which trade liberalisation influences poverty reduction. By analysing these channels, a comprehensive understanding of the complex relationship between trade and poverty emerges. This multifaceted approach allows policymakers to gain insights into the diverse mechanisms through which trade can impact poverty and design targeted strategies to maximise positive outcomes. Moreover, recognising the contextual variations and diverse impacts of trade on different populations enables the development of inclusive and tailored poverty reduction policies.

What are the differential impacts of trade liberalisation on poverty reduction across different regions and countries?

This section examines the relationship between trade liberalisation and poverty reduction in various countries and regions. Table 5 provides a detailed discussion of the differential impacts of trade liberalisation on poverty reduction across different regions and countries. Comparing different country and regional studies allows for a deeper understanding of the diverse poverty impacts of trade liberalisation.

The reviewed papers highlighted the variation in outcomes across countries, regions, and economic contexts, emphasising the importance of tailored policies that consider country-specific factors when designing trade reforms and poverty reduction strategies. The studies on African countries, Argentina, Bangladesh, Brazil, Cambodia, Lao PDR, Thailand, and Vietnam presented mixed findings, suggesting that the impacts of trade liberalisation on poverty reduction were diverse and context-specific. Some studies focused on the agricultural sector, examining the effects of trade liberalisation on rural poverty. Findings from Chile, China, India, Indonesia, the Philippines, and Vietnam suggested that the relationship between trade liberalisation and poverty reduction in rural areas was complex and dependent on specific circumstances.

Contextual factors also played a significant role in shaping the impacts of trade liberalisation on poverty reduction. Studies conducted in South Africa, Sub-Saharan Africa, and Zimbabwe highlighted the importance of institutional capacity, labour markets, economic reforms, and governance structures in mediating the relationship between trade liberalisation and poverty reduction. The review also sheds light on the influence of trade-related policies on poverty

reduction outcomes. Studies from Ecuador, Ghana, Pakistan, and Sri Lanka explored the effectiveness of specific trade policies and their impacts on poverty reduction.

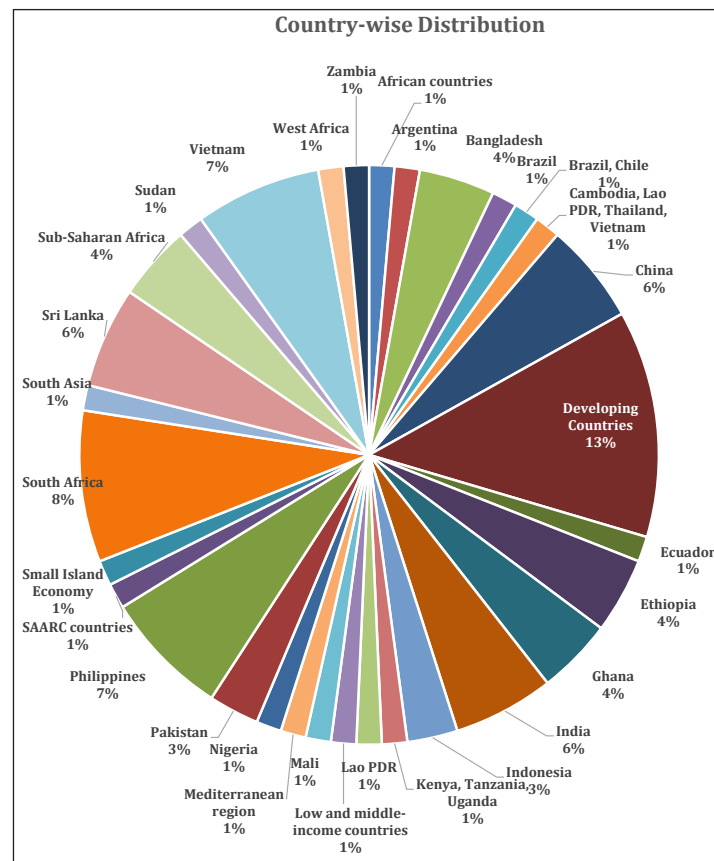
For instance, Onakoya et al. (2019) examine the poverty effects of trade liberalisation in 21 African countries and highlight the diverse outcomes across countries due to variations in economic structures, policies, and institutional factors. Similarly, Castilho et al. (2012) analyse the relationship between trade liberalisation, inequality, and poverty in different Brazilian states, emphasising the regional variations in poverty outcomes resulting from trade reforms. Mohamed (2011) in his study emphasises the need for country-specific policies by analysing the relationship between trade liberalisation and poverty in developing countries. He posits that the effectiveness of trade reforms in reducing poverty depends on specific country characteristics and policy interventions.

Lemi (2012) explores the poverty dynamics in rural Ethiopia and emphasises the importance of targeted policies to address poverty reduction challenges in the specific context of Ethiopia, Dunne and Edwards (2007) underscore the importance of policies that consider the trade-labour linkages to address poverty issues specific to South Africa. Chhikara

and Lal (2020) examine the impact of international trade on poverty reduction in India post-globalisation (1990–2012). The study highlighted that globalized trade can effectively reduce poverty in India when complemented with appropriate domestic policies. These policies may include investments in education and skills training to enhance workforce productivity, infrastructure development to facilitate trade, targeted social welfare programs to support vulnerable populations, and measures to promote inclusive growth and equitable distribution of benefits from trade.

China, being a significant player in global trade, received considerable attention in studies exploring the impacts of trade liberalisation on poverty reduction. Huang, Jikun, Jun, Yang, Xu, Zhigang, Rozelle, Scott and Li, Ninghui (2007), Liang, Zhicheng (2007), Wang, Jun and Hu, Yong (2018), and Wang, Yan, Libin, Huang, Wen and Chen (2022) all provided insights into the multidimensional relationship between trade liberalisation and poverty reduction in China.

Thus, the comparative analysis underscores the importance of considering specific contexts, sectoral dynamics, and policy interventions when analysing the relationship between trade liberalisation and poverty reduction across diverse regions and countries.



Source: Author.

Fig. 3: Country-Wise Distribution of Papers Published

CONCLUSION AND POLICY IMPLICATIONS

The present study attempted to explore the relationship between poverty and international trade, highlighting both the limitations and potential opportunities for poverty reduction. By systematically synthesising recently produced empirical knowledge from various countries, this paper sought to understand how poverty, a critical socioeconomic issue with wide-ranging implications, is influenced by and connected to international trade dynamics. The evidence surveyed in this paper demonstrates that there is no simple general conclusion regarding the nexus between trade liberalisation and poverty reduction.

This review highlights three important insights. Firstly, the inquiry into the extent to which trade liberalisation contributes to poverty reduction in developing countries reveals a complex and nuanced relationship. Among the examined studies, many studies suggest that trade liberalisation generally elevates average incomes, temporarily fostering economic growth. The literature further highlights the context-dependent impact of trade liberalisation, with instances where it significantly reduces poverty, especially benefiting rural and agricultural sectors (Hertel et al., 2003). However, the outcomes are not universally consistent, with instances where the impacts of trade liberalisation prove intricate and regionally variable, even to the extent of producing negative results. In certain cases, the aftermath of trade liberalisation is less favourable, particularly noted in scenarios where trade-oriented policies exacerbate food security concerns, exacerbate employment challenges, and contribute to heightened absolute poverty. The impact on specific industries, such as the clothing sector in South Africa, highlights the differential impacts on diverse sectors and vulnerable populations (Van der Westhuizen, 2007).

Secondly, while most of the studies lean towards endorsing multilateral trade liberalisation as generally favourable for poverty reduction, the variations across regions, methodologies, and country-specific contexts necessitate a deeper understanding of the channels through which trade liberalisation influences poverty reduction. The exploration of these specific channels underscores a range of mechanisms that intertwine trade policy with poverty alleviation. These mechanisms encompass economic growth, employment effects, increased exports, enhanced productivity, impacts on wages and income levels, access to cheaper imports, Foreign Direct Investment (FDI), government regulations and policies, heightened competition, and technological spillovers. This comprehensive analysis emphasises that multiple interconnected factors contribute to the complex

interplay between trade and poverty reduction.

Finally, the investigation into the differential impacts of trade liberalisation on poverty reduction across various regions and countries underscores the necessity of context-sensitive policies. The reviewed studies highlight the divergence in outcomes due to varying economic structures, policies, and institutional factors. Country-specific characteristics, labour markets, economic reforms, and governance structures play pivotal roles in mediating the relationship between trade liberalisation and poverty reduction. The analysis highlights the significance of customised policies that consider specific circumstances to maximise positive outcomes.

It's important to acknowledge a few limitations of the study, including potential data biases, variability in measurement methods, and challenges in isolating the impacts of trade liberalisation from other factors. Firstly, while we have put forth considerable effort to conduct a thorough and extensive literature search, it is plausible that we might have overlooked certain studies. This could stem from studies that are not available digitally or have not been included in the academic databases we relied on. Our focus has also been constrained by language, as we have concentrated on studies published in English since 2000, given the limitations of time and resources. Secondly, it is important to clarify that we have not aimed to analyse studies in terms of their analytical quality or employed methodologies. Rather, our primary goal has been to document and juxtapose results from various studies, while also assessing the reasons behind any divergences in outcomes. Finally, the one moderating variable that could be viewed through this lens – the presence of studies published in peer-reviewed academic journals – did not statistically impact the size or direction of the effects of trade on poverty.

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APPENDIX

Table 3: Contribution of Trade Liberalisation to Poverty Reduction in Developing Countries

Author and Year	Main Findings	Impact of Trade on Poverty Reduction
Onakoya, Adegbeni; Johnson, Babatunde; Ogundajo, Grace (2019)	FDI and inflation rate were positively related to the human development index, while exchange rates and trade openness were negatively related to poverty levels.	+
Barraud, Ariel, A.; Calfat, Germán (2008)	Trade liberalisation led to a reduction in poverty, particularly benefiting households linked to the non-tradable sectors.	+
Rahman, Mohammad Mahbubur; Fang, Cheng (2020)	Full tariff withdrawals from food imports reduced domestic food prices, leading to increased welfare for consumers but potential income loss for labourers and sellers of food items. Overall, rice trade liberalisation had a modest impact on poverty reduction.	+/-
Castilho, Marta; Menéndez, Marta; Sztulman, Aude (2012)	Trade liberalisation contributed to poverty and inequality reduction in rural areas but had mixed effects in urban areas.	+/-
Hertel, Thomas, W.; Preckel, Paul, V.; Cranfield, John, A. L.; Ivanic, Maros (2003)	The poverty headcount increased slightly for self-employed agricultural households in the short run but decreased for all earnings strata in the long run.	+
Strutt, Anna; Hertel, Thomas, W.; Stone, Susan (2010)	Full removal of intra-ASEAN tariffs resulted in substantial poverty reduction in the region, particularly benefiting agricultural and rural diversified households.	+
Fleming, D. A.; Abler, D. G.; Goetz, S. J. (2010)	Higher agricultural tradability was associated with lower poverty rates across different regions in Chile.	+
HUANG, Jikun; JUN, Yang; XU, Zhigang; Rozelle, Scott; LI, Ninghui (2007)	Trade liberalisation had a positive impact on average farm households, but regional heterogeneity existed. Poorer households, particularly in western China, were negatively affected.	+/-
Liang, Zhicheng (2007)	Trade liberalisation had mixed effects on poverty status, with changes in prices of cash crops increasing the probability of remaining poor, while changes in staple food crop prices and access to credit and schools increased the probability of escaping poverty.	+/-
Wang, Jun; Hu, Yong (2018)	Trade liberalisation reduced the poverty probability of rural residents and promoted income growth through mechanisms such as economic growth and financial expenditure.	+
Wang, X. Y.; Yan, H. L.; Libin, E.; Huang, X. Y.; Wen, H. Z.; Chen, Y. (2022)	Multidimensional poverty reduction strategies, including foreign trade and urbanisation, were crucial for poverty alleviation in China.	+
Gnangnon, Sena Kimm (2019)	The empirical analysis suggests that multilateral trade liberalisation is favourable for poverty reduction in developing countries.	+
Jeong-Soo, O. H.; Kyophilavong, Phouphet (2015)	The Relationship between trade liberalisation and poverty is ambiguous and varies by country, methodology, and trade variables.	+/-
Litchfield, Julie; McCulloch, Neil; Winters, L. Alan (2003)	Trade liberalisation in China, directly and indirectly, reduces urban poverty through favourable impacts on economic growth.	+
Mohamed, Issam. A. W. (2011)	Trade liberalisation in Guyana expands export supply and reduces poverty, though overall impact is relatively small.	+
Mohamed, Issam, A. W. (2011)	Trade liberalisation and market-oriented policies may worsen food security, employment rates, and aggravate absolute poverty, emphasising the need for proper tax policies and macroeconomic stability.	-
Santos-Paulino, Amelia, U. (2017)	Manufacturing exports reduce poverty in developing countries, while agricultural exports have a larger effect on poverty in low-income countries.	+

Author and Year	Main Findings	Impact of Trade on Poverty Reduction
Vos, Rob; Jong, Niek De (2003)	Trade liberalisation in Ecuador leads to mild aggregate welfare gains but increases income inequality, resulting in virtually no poverty reduction.	+/-
Lemi, Adugna (2012)	Trade-related employment, including export, import-competing, and manufacturing sectors, significantly contributes to rural household welfare in Vietnam, with varying effects across different welfare/ income groups.	+
Sindu, W. Kebede; Fekadu, Belay; Aredo, Dejene (2016)	Trade liberalisation has a negative short-run effect on Ethiopia's overall economy, increasing poverty levels, particularly among entrepreneur households.	-
Anang, S. A.; Yanwen, T. (2014)	Agricultural trade liberalisation policies in Ghana have both positive and negative effects on rice production but generally contribute to increased incomes and poverty reduction among farmers.	+/-
Ocran, Matthew Kofi; Adjasi, Charles, K. D. (2009)	Liberalisation of manufacturing industries is more pro-poor than agricultural industries in Sri Lanka, suggesting uneven gains across household groups and the need for inclusive and equitable long-term policies.	+/-
Modeste, Nelson, C. (2019)	Trade liberalisation impacts industrial development, especially in poverty-affected contexts where stalling trade liberalisation may serve development purposes.	+
Cain, Jewelwayne; Hasan, Rana; Mitra, Devashish (2012)	Increased exposure to foreign trade in India contributes to poverty reduction, with about 38% of poverty reduction during 1987-2004 attributable to changes in trade exposure.	+
Pant, M.; Dhamija, N. (2021)	Trade openness positively influences per capita income levels and leads to poverty reduction in India, while consumption inequality is not significantly affected.	+
Topalova, Petia (2010)	The 1991 Indian trade liberalisation leads to slower poverty decline and lower consumption growth in rural districts with more exposure to liberalisation, particularly affecting the regions with inflexible labour laws.	+
Ural, Beyza, P.; Mitra, Devavish; Hasan, Rana (2007)	Empirical investigation supports the poverty-reducing effects of trade reforms in India, indicating a positive impact on poverty reduction.	+
Kis-Katos, Krisztina; Sparrow, Robert (2015)	Trade liberalisation in Indonesia contributed to poverty reduction through increased firm competitiveness and job creation, particularly in districts with greater exposure to input tariff liberalisation.	+
Sofjan, Muhammad (2018)	Trade liberalisation in Indonesia helped lift the poor above the poverty line by creating job opportunities but did not significantly reduce income inequality.	+
Read, Donna; Parton, Kevin (2009)	Despite trade liberalisation policies, outcomes have been disappointing in Kenya, Tanzania, and Uganda due to constraints in the international economy and domestic resource limitations.	-
Fane, George (2006)	Trade has reduced poverty in the long run in Mauritius, along with economic growth and education as important factors.	+
Viet, C. N. (2015)	Trade facilitation, measured by export and import document requirements, helped decrease poverty and inequality in low- and middle-income countries.	+
Togo, Adjouro (2020)	Trade liberalisation in Mali negatively affected poverty proxies in the long run, depending on complementary policies such as financial deepening, education, institutional quality, and infrastructure development.	+

Author and Year	Main Findings	Impact of Trade on Poverty Reduction
Hassine, Nadia Belhaj; Kandil, Magda (2009)	Trade openness positively influenced farming efficiency, agricultural productivity, and poverty reduction in Mediterranean countries.	+
Shuaibu, Mohammed (2017)	Agriculture and manufacturing sector trade liberalisation moderately reduced poverty in Nigeria, with a more pronounced effect in urban centers. However, trade liberalisation alone cannot address the rising incidence of poverty.	+/-
Chishti, Anwar, F.; Malik, Waqar (2001)	Tariff reduction without a decline in remittances reduced poverty in Pakistan, particularly in rural and urban areas. The combined shock of trade liberalisation and a decline in remittances negatively impacted urban households.	+
Siddiqui, Rizwana; Kemal, A. R. (2006)	Tariff cuts in the Philippines were generally poverty-reducing, benefiting unskilled urban workers and leading to falling consumer prices and increased direct taxes.	+
Cororaton, C. B.; Cockburn, J. (2007)	Tariff cuts in the Philippines between 1994 and 2000 generally reduced poverty through lower consumer prices and increased direct taxes. Alternative scenarios using increased sales taxes had more negative poverty implications.	+/-
Cororaton, Caesar, B.; Cockburn, John (2006)	The study suggests that trade policy reforms in the 1990s may initially increase poverty but can ultimately reduce poverty and have positive environmental impacts with appropriate government interventions.	+/-
Coxhead, Ian; Jayasuriya, Sisira (2004)	Globalisation promotes faster economic growth and poverty reduction, highlighting the potential of trade liberalisation	+
Ghazanfar, Ummara; Lodhi, R. Nawaz; Bandeali, Marium Sara Minhas; Khalil, Arslan (2021)	Significant short-run relationship between trade liberalisation and poverty in Bangladesh and Pakistan, while no significant relationship exists in India. Long-run results vary across countries.	+/-
Fauzel, Sheereen (2022)	This study examines the effects of global rice and agricultural trade liberalisation on Bangladesh, India, Pakistan, and Sri Lanka. It investigates welfare and poverty outcomes, supporting the advantages of trade liberalisation.	+
Dunne, P.; Edwards, L. (2007)	Provinces in Thailand exposed to greater tariff reduction experience more rapid poverty reduction and income growth, especially in urban areas. Labor mobility is hypothesised as a potential channel for this effect.	+
Edwards, L.; Stern, M. (2007)	Democracy increases income poverty in non-oil-producing countries and has no effect in oil-producing countries. Trade openness does not significantly impact poverty.	-
Herault, Nicolas (2007)	Trade liberalisation leads to a decrease in poverty in South Africa due to increased formal employment levels, offsetting nominal earnings decreases for low-skilled and skilled workers.	+
Mabugu, Ramos; Chitiga Mabugu, Margaret (2014)	Tariff cuts without fiscal policy adjustments lead to increased economic growth and reduced poverty incidence in Sri Lanka. However, when tariff cuts are combined with fiscal policy adjustments for budget neutrality, poverty outcomes become mixed.	+/-
Van der Westhuizen, S. (2007)	Trade liberalisation in the clothing industry in South Africa results in increased poverty, employment losses, and social dislocation, particularly affecting predominantly female workers.	-
Corina Filipescu (2008)	GATT reforms improved market integration and efficiency, focusing on the beef and wheat markets. Time series methods consistently suggest that GATT reforms promoted market integration, poverty reduction and improved efficiency.	+

Author and Year	Main Findings	Impact of Trade on Poverty Reduction
Naranpanawa, A.; Bandara, J. S.; Selvanathan, S. (2011)	Trade liberalisation reduces poverty in both rural and urban areas in the short run. In the long run, it reduces absolute poverty for all socio-economic groups. However, there is a slight increase in poverty gap and severity for urban areas.	+/-
Perera, Sumudu; Siriwardana, Mahinda; Mounter, Stuart (2014)	Trade liberalisation policies lead to a decrease in income inequality and poverty across urban, rural, and estate sectors in Sri Lanka. Unilateral trade liberalisation shows the most significant poverty reductions.	+
Fambeu, A. H. (2021)	Despite increased inequality, poverty incidence in Lao PDR has decreased due to trade liberalisation and rapid aggregate growth.	+
Sunge, Regret; Kumbula, Nyasha B.; Makamba, Biatrice, S. (2021)	Trade liberalisation leads to poverty gains in sub-Saharan Africa. Trade within the region and from MENA countries results in more significant poverty reductions. Improved institutional quality strengthens the poverty-reducing effects.	+
Yameogo, Claire Emilienne Wati; Omojolaibi, Joseph Ayoola (2021)	Trade liberalisation, institutional quality, and population growth lead to poverty reduction in the long run, but the impact of trade openness on poverty is adverse in the short run.	+/-
Mohamed, Issam, A. W. (2011)	Trade restrictions and barriers can affect income disparities and corruption. True democracy and transparency are necessary to ensure fair trade benefits for small producers and address poverty-related issues.	+
Durongkaverroj, Wannaphong; Ryu, Taehyun (2019)	The effects are not uniform, with winners and losers among the poor. Tariff liberalisation alone is insufficient to reduce poverty and unemployment, especially among the unskilled and rural poor.	+/-
Heo, Yoon; Doanh, Nguyen Khanh (2009)	Trade liberalisation in Vietnam has led to economic growth, pro-poor employment, higher wages, and indirect benefits through increased government revenue.	+
Jones, Nicola; Anh, Nguyen Ngoc; Hang, Nguyen Thu (2008)	The impact of trade liberalisation on children in poor communities varies based on household poverty status, vulnerability, parental education, and community poverty.	+/-
Le, Minh Son; Su, Jen-Je; Nguyen, Jeremy (2019)	Trade liberalisation initially had an adverse welfare impact on agricultural households in Ghana but later positively influenced welfare.	+
Le, Nga Van T.; Hoang, Trung Xuan; Tran, Tuyen Quang (2022)	Provinces in Vietnam with greater exposure to trade liberalisation experience pro-poor growth, with increased wages playing a crucial role.	+
Kaba, Ibrahim; Songyan, Zhang (2022)	International trade shows a negative correlation with poverty, and regional trade flows contribute to poverty reduction in West Africa.	+
Buffie, E. F.; Atolia, M. (2012)	Optimal policy packages combining escalated protection and export promotion yield the best results for poverty reduction and economic development, while free trade or low uniform tariffs are not considered optimal.	+

Table 4: Channels through Which Trade Liberalisation Influences Poverty Reduction

Channels of Trade Reducing Poverty	Author and Year	Findings
Economic Growth	Buffie, E. F.; Atolia, M. (2012)	Economic growth stimulated by trade leads to poverty reduction by enhancing employment opportunities and fostering diversification in Zambia's economy.
	Coxhead, Ian; Jayasuriya, Sisira (2004)	Trade liberalisation drives economic growth, contributing to poverty reduction through increased investments in infrastructure and sustainable development in the Philippines.

Channels of Trade Reducing Poverty	Author and Year	Findings
	Dollar, D.; Kraay, A. (2004)	Increased trade promotes economic growth, leading to poverty reduction by attracting foreign investments and expanding market access in various sectors.
	Duncan, Ron; Quang, Doan (2003)	Trade-driven economic growth plays a crucial role in poverty reduction by increasing productivity and creating employment opportunities in developing economies.
	Fauzel, Sheereen (2022)	Trade-induced economic growth is instrumental in poverty reduction by promoting entrepreneurship and improving access to international markets in small island economies.
	Gnangnon, Sena Kimm (2019)	Multilateral trade liberalisation fosters economic growth, contributing to poverty reduction by enhancing market integration and boosting productivity in developing countries.
	Kaba, Ibrahim; Songyan, Zhang (2022)	International trade stimulates economic growth, leading to poverty reduction by facilitating technology transfer and promoting investment in West Africa.
	Le, Nga Van T; Hoang, Trung Xuan; Tran, Tuyen Quang (2022)	Trade liberalisation in Vietnam facilitates economic growth, thus reducing poverty through improved access to global markets and increased employment opportunities.
	Litchfield, Julie; McCulloch, Neil; Winters, L. Alan (2003)	Agricultural trade liberalisation drives economic growth, which helps alleviate poverty by enhancing productivity and fostering rural development in developing countries.
	Mabugu, Ramos; Chitiga Mabugu, Margaret (2014)	Trade liberalisation in South Africa promotes economic growth, thereby reducing poverty and inequality through increased investments and job creation.
	Pant, M.; Dhamija, N. (2021)	Trade liberalisation in India spurs economic growth, contributing to poverty reduction through improved competitiveness and increased employment opportunities.
	Wang, Jun; Hu, Yong (2018)	Trade liberalisation enhances economic growth in rural China, leading to poverty reduction by promoting agricultural productivity and generating employment.
	Yameogo, Claire Emilienne Wati; Omojolaibi, Joseph Ayoola (2021)	Trade liberalisation fosters economic growth in sub-Saharan Africa, contributing to poverty reduction by attracting investments and improving access to global markets.
	Read, Donna; Parton, Kevin (2009)	Economic deregulation and trade liberalisation promote economic growth, leading to poverty reduction in Kenya, Tanzania, and Uganda by enhancing competitiveness and attracting investments.
	Siddiqui, Rizwana; Kemal, A. R. (2006)	Trade liberalisation in Pakistan, coupled with remittances, contributes to poverty reduction by stimulating economic growth and creating employment opportunities.
Employment	Fane, George (2006)	Trade liberalization in Lao PDR leads to employment generation in export-oriented sectors, which helps reduce poverty.
	Cloutier, Marie-Hélène; Cockburn, John; Decaluwé, Bernard; Raihan, Selim; Khondker, Bazlul, H. (2008)	Trade liberalization creates jobs and reduces poverty by increasing demand for labor in competitive sectors.
	Lemi, Adugna (2012)	In Ethiopia, trade liberalization enhances employment opportunities in agriculture and related industries, alleviating poverty.
	Mohamed, Issam, A. W. (2011)	In developing countries, trade liberalisation drives employment growth in various sectors, significantly contributing to poverty alleviation.

Channels of Trade Reducing Poverty	Author and Year	Findings
	Naranpanawa, A.; Bandara, J. S.; Selvanathan, S. (2011)	In Sri Lanka, liberalised trade policies generate employment in export-driven industries, which helps reduce poverty levels.
	Ocran, Matthew Kofi; Adjasi, Charles K. D. (2009)	Ghana's trade liberalisation leads to the creation of jobs, especially in the industrial sector, thereby reducing poverty through increased household incomes.
	Rahman, Mohammad Mahbubur; Fang, Cheng (2020)	Liberalisation of food trade in Bangladesh enhances employment in the agricultural sector, leading to reduced poverty and improved livelihoods.
	Winters, L. Alan; Martuscelli, Antonio (2014)	Over a decade, trade liberalisation has been linked to job creation in developing economies, which has played a crucial role in poverty reduction.
Increased exports	Anang, S. A.; Yanwen, T. (2014)	Increased exports due to trade liberalisation improve income for smallholder rice farmers, leading to poverty reduction in rural Ghana.
	Barraud, Ariel A.; Calfat, Germán (2008)	Trade liberalisation in Argentina has facilitated a notable surge in exports, directly correlating with poverty reduction through job creation and enhanced income distribution.
	Cain, Jewelwayne; Hasan, Rana; Mitra, Devashish (2012)	Gujarat and Maharashtra experienced a significant rise in export volumes after liberalisation in the 1990s, leading to a corresponding decrease in poverty rates by up to 15% in some regions.
	Le, Minh Son; Su, Jen-Je; Nguyen, Jeremy (2019)	Export growth following trade liberalisation in Vietnam has significantly reduced poverty, with the poverty rate dropping from over 70% in the 1990s to less than 6% by 2019.
	Santos-Paulino, Amelia U. (2017)	By expanding market access and increasing production levels, exports create a demand for labour, leading to job creation. This rise in employment helps lift individuals and households out of poverty by providing them with stable incomes.
	van der Westhuizen, S. (2007)	The South African clothing industry's export growth following trade liberalisation has led to poverty reduction by providing employment and improving worker incomes.
	Viet, C. N. (2015)	Improved trade facilitation and increased exports have reduced poverty and inequality in low- and middle-income countries by promoting economic growth and better income distribution.
	Modeste, Nelson C. (2019)	Increased export supply resulting from trade liberalisation in Guyana has played a crucial role in poverty reduction by enhancing household incomes and economic stability.
Increased Productivity	Corina Filipescu (2008)	Agricultural trade liberalisation enhances productivity, leading to poverty reduction by increasing agricultural output and improving welfare in South Asia.
	Durongkaveroj, Wannaphong; Ryu, Taehyun (2019)	Trade liberalisation in Thailand drives productivity growth, contributing to poverty reduction by increasing incomes and fostering economic development.
	Hall, Ronnie (2006)	Increased resource efficiency, leads to poverty reduction by enhancing productivity and sustainable development.
	Harrison, Glenn W.; Rutherford, Thomas F.; Tarr, David G. (2003)	Trade liberalisation enhances economic efficiency and productivity, leading to poverty reduction and improved equity in income distribution.
	Hassine, Nadia Belhaj; Kandil, Magda (2009)	Productivity growth contributes to poverty reduction by increasing agricultural output and improving welfare in the Mediterranean region.

Channels of Trade Reducing Poverty	Author and Year	Findings
	Maseland, Robbert; Vaal, Albert de (2011)	Trade-induced comparative advantage fosters productivity growth, contributing to poverty reduction by promoting specialization and efficiency.
	Shuaibu, Mohammed (2017)	Enhanced productivity resulting from trade liberalisation promotes investment and fosters economic growth in Nigeria, thereby contributing to poverty reduction.
	Sindu, W. Kebede; Fekadu, Belay; Aredo, Dejene (2016)	Increased productivity stimulated by trade liberalisation fosters growth in agricultural output, thereby aiding in poverty reduction and enhancing welfare in Ethiopia.
Increased wages	Dunne, P.; Edwards, L. (2007)	Trade in South Africa positively impacts wages, potentially alleviating poverty through improved labour market conditions.
	Heo, Yoon; Doanh, Nguyen Khanh (2009)	Trade liberalisation in Vietnam is associated with increased wages, contributing to poverty reduction efforts.
	Hertel, Thomas W.; Ivanic, Maros; Preckel, Paul V; Cranfield, John A. L. (2004)	Multilateral trade liberalisation has positive implications for earnings, potentially reducing poverty by improving wage dynamics.
	Kis-Katos, Krisztina; Sparrow, Robert (2015)	Trade liberalisation in Indonesia impacts labour markets and leads to increased wages, potentially reducing poverty levels.
	Perera, Sumudu; Siriwardana, Mahinda; Mounter, Stuart (2014)	In Sri Lanka, trade liberalisation correlates with higher wages and improved income distribution, aiding poverty reduction.
	Ural, Beyza P.; Mitra, Devavish; Hasan, Rana (2007)	Labor-market institutions in Indian states, alongside trade liberalisation, positively influence wage levels, contributing to poverty mitigation.
Increased Income	Vos, Rob; Jong, Niek De (2003)	Through a CGE Macro-Microsimulation Analysis, trade liberalization in Ecuador is associated with an increase in income, potentially impacting poverty levels positively.
	Winters, L. Alan (2002)	The relationship between trade liberalization and poverty is explored, highlighting potential avenues through which trade can contribute to increased income and poverty reduction.
Access to cheaper imports	Castilho, Marta; Menéndez, Marta; Sztulman, Aude (2012)	Trade liberalisation in Brazilian states enhances access to cheaper imports, potentially reducing inequality and poverty levels.
	Edwards, L.; Stern, M. (2007)	Trade policies in South Africa can alleviate poverty, likely through improved access to cheaper imports.
	Nahar, Bodrun; Siriwardana, Mahinda (2009)	Trade liberalization in Bangladesh is quantitatively assessed for its impact on poverty, including the potential benefits of access to cheaper imports.
	Herault, Nicolas (2007)	Trade liberalisation in South Africa reduces poverty and inequality by enhancing access to cheaper imports.
Foreign direct investment (FDI)	Hertel, Thomas W.; Preckel, Paul V.; Cranfield, John A. L.; Ivanic, Maros (2003)	Multilateral trade liberalisation, accompanied by FDI, contributes to poverty reduction in Brazil and Chile.
	HUANG, Jikun; JUN, Yang; XU, Zhigang; ROZELLE, Scott; LI, Ninghui (2007)	Agricultural trade liberalisation in China impacts poverty levels through increased FDI and economic growth in rural areas.
	Wang, X. Y.; Yan, H. L.; Libin, E.; Huang, X. Y.; Wen, H. Z.; Chen, Y. (2022)	Foreign trade and urbanisation in China contribute to poverty reduction through increased FDI inflows and economic development.
Government Regulation	Chishti, Anwar F.; Malik, Waqar (2001)	Trade liberalisation in Pakistan, facilitated by WTO regulations, could alleviate poverty through increased agricultural growth.

Channels of Trade Reducing Poverty	Author and Year	Findings
	Cororaton, C. B.; Cockburn, J. (2007)	Trade reform policies in the Philippines, analyzed through CGE-microsimulation, help reduce poverty by creating new opportunities and enhancing economic growth.
	Cororaton, Caesar B.; Cockburn, John (2006)	Government regulations, including those by the WTO, significantly influence rural poverty in the Philippines, particularly within the rice sector.
	Fambeu, A. H. (2021)	The interplay of government regulations, democracy, and trade openness yields diverse outcomes for poverty reduction in sub-Saharan Africa.
	Mohamed, Issam, A. W. (2011)	The regulatory environment within trade liberalization initiatives in Sudan offers potential pathways for poverty alleviation.
	Ul-Haq, Jabbar; Wajid, Farwa; Visas, Hubert; Cheema, Ahmed Raza; Abbas, Shujaat (2022)	Intersection of government regulations and trade liberalisation dynamics shapes poverty scenarios, suggesting tailored poverty alleviation measures.
Increased competition	Ghazanfar, Ummara; Lodhi, R. A. B. Nawaz; Bandeali, Marium Sara Minhas; Khalil, Arslan (2021)	Enhanced competition resulting from trade liberalization in SAARC countries impacts poverty dynamics through market efficiency and innovation.
	Onakoya, Adegbemi; Johnson, Babatunde; Ogundajo, Grace (2019)	Trade liberalization in 21 African countries correlates with heightened market competition, likely influencing poverty levels by fostering economic diversification and efficiency.
Technological spillovers	Fleming, D. A.; Abler, D. G.; Goetz, S. J. (2010)	Trade-related technological advancements in Chile lead to increased agricultural productivity, innovation, and value-added production, contributing to poverty reduction in rural areas.
	Liang, Zhicheng (2007)	Technological spillovers from trade liberalization in China promote industrial growth, encouraging technological innovation, and creating employment opportunities, thereby improving living standards for urban residents.
	Mohamed, Issam, A. W. (2011)	GARCH analysis shows trade liberalization in developing countries promotes technological spillovers, fostering innovation, economic diversification, enhancing productivity, and reducing poverty.

Table 5: Varied Effects of Trade Liberalization on Poverty Reduction across Different Regions and Countries

Country	Authors	Publication Titles
African countries	Onakoya, Adegbemi; Johnson, Babatunde; Ogundajo, Grace (2019)	The relationship between trade liberalization and poverty reduction in African countries varies significantly due to diverse economic structures and policy frameworks.
Argentina	Barraud, Ariel, A; Calfat, Germán (2008)	Trade liberalisation in Argentina yields diverse impacts on poverty, indicating the importance of tailored policy responses to address regional disparities.
Bangladesh	Nahar, Bodrun; Siriwardana, Mahinda (2009) Rahman, Mohammad Mahbubur; Fang, Cheng (2020)	The effects of trade liberalisation on poverty in Bangladesh are context-specific, requiring nuanced policy interventions to mitigate poverty challenges.
Brazil	Castilho, Marta; Menéndez, Marta; Sztulman, Aude (2012) Hertel, Thomas, W; Preckel, Paul, V.; Cranfield, John, A. L.; Ivanic, Maros (2003)	In Brazil, the relationship between trade liberalization, inequality, and poverty underscores the regional variations in poverty outcomes post-trade reforms.
Cambodia, Lao PDR, Thailand, Vietnam	Strutt, Anna; Hertel, Thomas, W.; Stone, Susan (2010)	ASEAN trade liberalisation impacts poverty differently across Cambodia, Lao PDR, Thailand, and Vietnam, necessitating targeted poverty alleviation efforts.

Country	Authors	Publication Titles
Chile	Fleming, D. A.; Abler, D. G.; Goetz, S. J. (2010)	Agricultural trade liberalization in Chile influences spatial poverty dynamics, indicating the need for geographically targeted poverty reduction measures.
China	Huang, Jikun; Jun, Yang; Xu, Zhigang; Rozelle, Scott; Li, Ninghui (2007) Liang, Zhicheng (2007) Wang, Jun; Hu, Yong (2018) Huang, X. Y.; Wen, H. Z.; Chen, Y. (2022)	China's experience with trade liberalisation reveals multifaceted impacts on poverty, emphasising the importance of sector-specific policy interventions.
Developing Countries	Gnangnon, Sena Kimm (2019) Goldberg, Pinelopi Koujianou; Pavcnik, Nina (2004) Hertel, Thomas, W.; Ivanic, Maros; Preckel, Paul, V.; Cranfield, John, A. L.; Martin, Will (2003) Jeong-Soo, O. H.; Kyophilavong, Phouphet (2015) Litchfield, Julie; McCulloch, Neil; Winters, L. Alan (2003) Mohamed, Issam A. W. (2011) Santos-Paulino, Amelia U. (2017)	Multilateral trade liberalisation in developing countries has heterogeneous effects on poverty, highlighting the need for tailored poverty reduction policies.
Ecuador	Vos, Rob; Jong, Niek De (2003)	Trade liberalisation in Ecuador demonstrates complex macro-micro channels influencing poverty dynamics, necessitating integrated poverty reduction approaches.
Ethiopia	Lemi, Adugna (2012) Sindu, W Kebede; Fekadu, Belay; Aredo, Dejene (2016)	Targeted policies are crucial to addressing rural poverty in the specific context of Ethiopia.
Ghana	Anang, S. A.; Yanwen, T. (2014) Ocran, Matthew Kofi; Adjasi, Charles, K. D. (2009)	Agricultural trade liberalisation in Ghana affects poverty among rural smallholder rice farmers, emphasising the importance of sector-specific interventions.
Guyana	Modeste, Nelson, C. (2019)	Trade liberalisation in Guyana influences export supply and poverty dynamics, suggesting the importance of export-oriented poverty reduction strategies.
India	Cain, Jewelwayne; Hasan, Rana; Mitra, Devashish (2012) Pant, M.; Dhamija, N. (2021) Topalova, Petia (2010) Ural, Beyza P.; Mitra, Devavish; Hasan, Rana (2007)	Complex impacts necessitate complementary domestic policies to effectively reduce poverty, such as investments in education, infrastructure, and social welfare.
Indonesia	Kis-Katos, Krisztina; Sparrow, Robert (2015) Sofjan, Muhammad (2018)	Poverty dynamics are complex, requiring integrated strategies that address specific regional and sectoral challenges.
Kenya, Tanzania, Uganda	Read, Donna; Parton, Kevin (2009)	Economic deregulation and trade liberalization in Kenya, Tanzania, and Uganda influence poverty and growth, demanding integrated poverty alleviation approaches.
Lao PDR	Fane, George (2006)	Trade liberalisation in Lao PDR necessitates comprehensive policy interventions to address economic reform and poverty reduction challenges.
Low- and middle-income countries	Viet, C. N. (2015)	Trade facilitation in low- and middle-income countries affects poverty and inequality, demanding inclusive trade policies for poverty reduction.
Mali	Togo, Adjouro (2020)	Potential for poverty reduction exists, but comprehensive strategies are essential for effective outcomes
Mediterranean region	Hassine, Nadia Belhaj; Kandil, Magda (2009)	Trade liberalisation affects agricultural productivity and poverty in the Mediterranean region, necessitating targeted poverty alleviation policies.

Country	Authors	Publication Titles
Nigeria	Shuaibu, Mohammed (2017)	Trade liberalisation in Nigeria influences poverty through micro-macro frameworks, suggesting the need for coordinated poverty reduction efforts.
Pakistan	Chishti, Anwar F.; Malik, Waqar (2001)	WTO's trade liberalisation in Pakistan impacts agricultural growth and poverty alleviation, underlining the importance of inclusive trade policies.
Philippines	Siddiqui, Rizwana; Kemal, A. R. (2006) Cororaton, C. B.; Cockburn, J. (2007) Cororaton, Caesar B.; Cockburn, John (2006) Coxhead, Ian; Jayasuriya, Sisira (2004)	Trade reform in the Philippines reveals complex poverty dynamics, requiring comprehensive poverty reduction strategies that address sector-specific challenges.
SAARC countries	Ghazanfar, Ummara; Lodhi, R. A. B. Nawaz; Bandeali, Mariam Sara Minhas; Khalil, Arslan (2021)	The impact of trade on poverty in SAARC countries varies, emphasizing the need for country-specific policy responses to effectively reduce poverty.
Small Island Economy	Fauzel, Sheereen (2022)	Trade liberalisation in small island economies affects poverty reduction, highlighting the need for tailored trade policies to address unique economic contexts.
South Africa	Dunne, P.; Edwards, L. (2007) Edwards, L.; Stern, M. (2007) Herault, Nicolas (2007) Mabugu, Ramos; Chitiga Mabugu, Margaret (2014) van der Westhuizen, S. (2007)	Considering trade-labour linkages and targeted poverty reduction measures are crucial to addressing the poverty impacts in South Africa.
South Asia	Corina Filipescu (2008)	Inclusive trade policies are necessary to effectively address poverty and welfare dynamics across the region.
Sri Lanka	Liyanaarachchi, Tilak S.; Naranpanawa, Athula; Bandara, Jayatilleke, S. (2016) Naranpanawa, A.; Bandara, J. S.; Selvanathan, S. (2011) Perera, Sumudu; Siriwardana, Mahinda; Mounter, Stuart (2014)	Integrated macro-micro modelling approaches are needed to effectively address poverty reduction challenges.
Sub-Saharan Africa	Fambeu, A. H. (2021) Sunge, Regret; Kumbula, Nyasha B.; Makamba, Biatrice S. (2021) Yameogo, Claire Emilienne Wati; Omojolaibi, Joseph Ayoola (2021)	Mixed impact of trade on poverty reduction, influenced by democracy, economic reforms, and governance structures, highlights the need for context-specific strategies.
Sudan	Mohamed, Issam, A. W. (2011)	Effective institutional frameworks and country-specific policies are crucial to addressing poverty reduction.
Tanzania	Obeng, K. (2003) Schaefer, K. (2005)	The effects of trade liberalisation on poverty in Tanzania are mixed, emphasising the importance of tailored policy interventions to address specific poverty challenges.
Uganda	Morrissey, O; Filatotchev, Igor; Wright, M. (2000)	In Uganda, the impact on poverty is influenced by various channels, underscoring the necessity for comprehensive policy responses to effectively address these issues.
Vietnam	Hoang, Van Cuong (2006) Tarp, Finn; Roland-Holst, David (2002)	Trade liberalization's effects on poverty in Vietnam underscore the importance of considering specific sectoral and regional dynamics when designing poverty reduction strategies.
Zimbabwe	Mabugu, Ramos; Chitiga Mabugu, Margaret (2006) Odhiambo, Nicholas, M. (2010) Wenzel, Peter (2010)	Governance structures and institutional capacity play significant roles in mediating poverty reduction outcomes, requiring targeted approaches.

DESIGN THINKING FOR RELIABLE DIGITAL FINANCIAL INFORMATION

Jacques Hendieh*, Ioseb Gabelaia**

Abstract *The rapid changes in the finance industry regulations and fast-changing customer needs pressured banks to stay competitive. This is factored in due to the pace of innovation in technology. Banks have creative financial heads; however, pursuing efficient, customer-centric, creative work within an organisation is frequently challenging. Moreover, banks often operate in complex environments with legacy systems and processes, making conducting experiments rapidly with new ideas and technologies challenging. Likewise, banks often need more resources to invest in the right people, processes, systems, and technology to create a customer-centric core. The authors introduce design thinking as a robust methodology used in various fields, and its applications could ensure reliable digital financial information in today's contemporary business environments. This research article explores the existing literature to identify gaps in addressing the challenges associated with digital financial information reliability. Qualitative research examines the traces of these challenges and opportunities to propose and suggest innovative solutions through design thinking principles. The authors used a systematic literature review to evaluate and examine articles, reports, publications, and more related to the research problem. The findings highlighted five key weaknesses and opportunities, supplemented by a design thinking mapping table that draws and outlines potential solutions. This research increases the knowledge of digital financial systems, paving the way for more secure and reliable financial information for customers.*

Keywords: *Financial Statements, Design Thinking, Financial Accounting*

INTRODUCTION

There is an increasing dependence on digital financial information due to the quick digitisation of financial systems (Zhang et al., 2020). Hence, reliable financial information is crucial to performance in the financial environment. This research article aims to investigate ways how design thinking can be used to improve the vulnerabilities in the digital financial information systems that are now in use within banks. Moreover, this article is relevant in today's digital world, where digital platforms are becoming valuable for financial transactions. The research article's findings could significantly influence the security and dependability of digital financial data.

The financial sector has been changing. Financial institutions have been integrating cutting-edge technologies, while consumers have concerns about financial data accuracy.

Design thinking is a technique that focuses on innovative solutions through collaborative efforts. Moreover, various businesses use design thinking, and finance is not excluded. Design thinking includes five stages to identify and solve problems. The empathise stage targets end users' demands, habits, and preferences to acquire a thorough capacity for their difficulties. This comprehension is the foundation

for identifying the root causes and creating possible fixes. Testing and prototyping come next, allowing quick idea iteration and improvement in response to user feedback. Design thinking's structured process guarantees that ideas are workable and closely match user expectations.

Moreover, design thinking is effective in digital financial information because it recognises how dynamic and user-driven financial interactions are. Nevertheless, design thinking is relevant because it can handle the complex issues of digital financial systems. For instance, first and foremost, design thinking puts forward a user-centric methodology, ensuring that the requirements and experiences of the final user are prioritised during the problem-solving phase. This is remarkably significant in the financial sector, where user engagement, trust, and knowledge are fundamental for effectively adopting digital financial platforms.

Second, design thinking fosters collaboration between stakeholders, such as end users, technologists, designers, and finance specialists. So, the collective approach of design thinking nurtures a complete comprehension of the complexities integral to digital financial information systems, resulting in more extensive and constructive solutions. Additionally, the iterative design thinking methodology aligns with the rapidly growing technology.

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Financial systems constantly change, and design thinking enables quick fixes for new chances and problems, ensuring robustness and adaptability.

In conclusion, trustworthiness issues in digital financial information can be addressed tactically and strategically with a human-centred approach (Vyshak et al., 2022) such as design thinking. This is significant in promoting user involvement, facilitating teamwork, and offering fundamental solutions associated with digital financial circumstances. This research article aims to explore, identify, and suggest novel ways to improve dependability, security, and user experience in modern financial systems.

LITERATURE REVIEW

In the dynamic environment of the digital age, this research article investigates how design thinking ideas might be applied to improve the dependability of financial information systems and, therefore, a piece of information. Organisations may effectively manage the challenges of digital transformation by utilising a user-centric approach, which guarantees the accuracy, accessibility, and resilience of financial data against interruptions (Zhang et al., 2020; Almahdi & Yan, 2018; Ertenlice & Kalayci, 2018; Ozbayoglu et al., 2020).

Small fintech startups and big technology enterprises continuously challenge incumbent financial institutions to find ways to offer new, customer-centric, and, most importantly, digital services (Singh et al., 2024; Feher & Varga, 2019). Therefore, finance has to manage and adapt to the Digital Era (Mosteanu & Faccia, 2020).

Due to the potential of digital banking, bank institutions invest in digital banking to obtain substantial benefits and stay competitive with the challenges of the digitalisation era (Indriasari et al., 2021). Besides, public finance and economic development management are the arts by which a nation improves its people's economic, political, and social well-being (Mosteanu & Faccia, 2020; Lv et al., 2021; Yu et al., 2020; Mhlanga, 2020).

The financial data management environment has changed due to digital transformation, requiring creative solutions to meet businesses' changing demands (Li et al., 2021; Yu et al., 2020). Organisations can create financial information systems that offer precise and timely data and enhance the resilience and sustainability of their operations. They can do this by methodically using design thinking (Ozbayoglu et al., 2020; Manjunath et al., 2021). Additionally, businesses must help maintain operations while handling financial data in the

quickly changing digital age (Zhang et al., 2020). Design thinking, with its emphasis on empathy, teamwork, and iterative problem-solving, offers a strategic framework for creating financial information systems that are dependable and flexible enough to change with the rapidly evolving digital environment (Yu et al., 2020; Lv et al., 2021).

Financial markets and technological evolution are related to every human activity in the past few decades (Hasan et al., 2020). Big data technology connects the financial services industry and will drive future innovations (Hasan et al., 2020; Yu et al., 2020; Lv et al., 2021).

Today, computational intelligence in finance is a trendy topic for academia and the financial industry, so numerous studies have been published, resulting in various models (Ozbayoglu et al., 2020). Financial data forecasting is conducive to better understanding the future economic situation (Huang et al., 2021; Zhang et al., 2020).

FINANCIAL INFORMATION SYSTEMS

Financial information systems portray the networked parts, procedures, and technologies an organisation uses to gather, process, store, and distribute financial data (Lv et al., 2021; Manita et al., 2020; Zhang et al., 2020). Besides aiding decision-making measures, guaranteeing regulatory compliance, and improving an organisation's overall financial stability, these systems are necessary for managing and reporting financial data (Ozbayoglu et al., 2020; Wuyu et al., 2020). Systems gather financial information from multiple sources within a company (Almahdi & Yan, 2018). Some examples are accounting transactions, sales records, inventory data, payroll information, etc. (Ertenlice & Kalayci, 2018). Moreover, automation is often a crucial element, assisting in restructuring the data collection procedure and reducing the prospect of mistakes (Aguilar-Rivera et al., 2015; Zhang et al., 2020; Lv et al., 2021).

After data is collected, financial information systems process and arrange it into applicable and valuable information (Lv et al., 2021). This requires applying accounting rules, completing computations, and classifying transactions (Yu et al., 2020; Hasan et al., 2020). The objective is to convert unprocessed data into precise and practical financial data. Furthermore, databases and other data repositories hold financial data (Ozbayoglu et al., 2020; Mhlanga, 2020). Effective systems for storing and retrieving data ensure that users get the data required for analysis, reporting, and making decisions promptly (Chen et al., 2023).

Reports on financial performance and position are created by financial information systems (Kar, 2020). For instance, cash flow statements, balance sheets, income statements, and other financial statements are examples of these reports (Feher & Varga, 2019; Zhang et al., 2020; Lv et al., 2021). Reporting tools aid in summarising complex financial data into a form that investors, management, and regulatory bodies understand for further decision-making (Ozbayoglu et al., 2020; Mosteanu & Faccia, 2020). Therefore, decision support tools are made accessible through financial information systems to facilitate management to make well-informed decisions (Indriasari et al., 2021). For instance, these tools include financial modelling, forecasting, budgeting, and scenario analysis (Feher & Varga, 2019).

Organisations can increase resource allocation and make informed strategic decisions based on dependable financial data (Hasan et al., 2020). Besides, organisations can observe financial regulations and reporting standards with the aid of FIS (Ozbayoglu et al., 2020; Lv et al., 2021). These systems frequently have mechanisms that ensure obedience to legal standards and accounting rules (Huang et al., 2021). They strengthen risk management by monitoring and disclosing financial risks (Manjunath et al., 2021).

Security is a fundamental component of financial information systems since financial data is sensitive (Indriasari et al., 2021; Hasan et al., 2020). Security measures are put in place by these systems to protect against illegal access to or modification of data (Huang et al., 2021). Moreover, audit trajectories keep track of modifications made to financial data and display who accessed or changed it. Additionally, FIS needs to be scalable (Ozbayoglu et al., 2020). This requires managing rising financial transaction volumes, accommodating new reporting standards, and integrating new technologies (Li et al., 2021). Lastly, using financial information systems efficiently requires an interface that is easy to use. Accessibility features accelerate remote work and partnership by guaranteeing authorised users can access financial data from various locations (Mosteanu & Faccia, 2020; Lv, Shao & Lee, 2021).

The basis of an organisation's financial management is its financial information systems (Huang et al., 2021). They endow effective financial data handling, facilitate decision-making, and support risk management practices (Ozbayoglu et al., 2020). Organisations hoping to be competitive and financially stable in the digital age must build and execute robust financial information systems (Li et al., 2021; Mosteanu & Faccia, 2020; Hasan et al., 2020; Ozbayoglu et al., 2020).

One of the most studied sectors in the global economy is the finance sector. Organisations' continuous changes and their role in the global digital finance system generate loads of structured and unstructured data. Any institution using this financial data efficiently will improve its internal business processes and decision-making. As an example of the importance of digital data, we refer to modern commercial banks that use customer data to predict their behaviour and needs and deliver targeted personalised banking products to them. In addition, digital data can enable new forms of artificial intelligence algorithmic trading and specific personalised asset management (Serrano et al., 2023).

To benefit from these data, organisations need to find effective ways to analyse and manage a large volume of unstructured, semi-structured, and structured data. Processing these different types of data requires significantly using analytics algorithms and some real-time analytics to subtract meaningful information from heterogeneous data types. Managing this heterogeneous data has become one of the biggest concerns and challenges in the financial sector. A considerable amount of time and money is spent by companies on their IT resources and know-how in order to improve their usage of the available data. Despite the current evolution in Artificial Intelligence, Blockchain, and Big Data technologies, there is still a need for a new and different solution to understand better and manage the above-cited challenges and to be able to use financial data more efficiently; for example, there is a need for big data applications for digital finance that could be customised to each company's needs (Soldatos & Kyriazis, 2022).

Recently, users of digital finance information raised the issue of transparency in operating the currently used Big Data systems. This transparency issue is considered an essential prerequisite for the wider use and adoption of the new analytics systems. A recent working paper by the Bank of England in 2019 illustrated the importance of providing explained and transparent credit risk decisions (Bracke et al., 2019).

DESIGN THINKING: DEFINITION, GENERAL SCOPE, AND BENEFITS FOR INNOVATION

Within a constantly changing environment, leaders and managers face many challenges to overcome those uncertainties and complexities. Since 1950, multiple research projects have focused on innovation and its characteristics, especially regarding uncertainty (Hofstede, 2016; Simon &

March, 2015; Olson et al., 2014). Recent studies focused on the management approaches to reach performance objectives within this uncertainty and the surrounding risks (Pleis, 2014). Some existing literature discussed those technological innovations and their impact on uncertainty (Rai & Gupta, 2022; Blok & Lemmens, 2015). However, those technological innovations are not the only factor that led to uncertainty; we can find this uncertainty in all new ideas and processes.

Effective management of the innovation process should direct this innovation through a responsible development path, considering its impacts on external factors, such as social, economic, and environmental factors (Pavie & Daphne, 2015).

The most commonly used definition of design thinking is: “a discipline that uses the designer’s sensibility and methods to match people’s needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity” (Brown, 2008). This method appeared in the 1980s but was more developed by Kelly and Brown in the 1990s (Kelley, 2001).

With applications in many fields, design thinking is becoming a pragmatic technique for facilitating human-centred design (HCD), a modern-day necessity, through a well-defined systematic process. (Manjunath, Sohan & Subramanya, 2021).

DESIGN THINKING METHOD FOR DEVELOPING RESPONSIBLE INNOVATIONS

It was proven that design thinking is a powerful tool to solve “wicked problems” (Zimmerman et al., 2010) that have no simple or straightforward method of solution (Rittel & Webber, 1973). Moreover, creating reliable financial statements instantly for organisations represents a wicked problem.

This technique uses a three-pronged approach to solve problems based on needs and technical aspects (Brown, 2008). This approach includes this solution’s human need or desirability, business needs or viability, and technical feasibility.

Design thinking has become an essential part of the innovation process. In addition to its traditional role in the downstream innovation process that provided limited results in user value creation, design thinking has become an integral part of the innovation process. Today, it plays a strategic role in value creation by creating new ideas and innovations that exceed the customers’ expectations. Due to their linkage with strategies, design thinking methods will vary from one organisation to another and from one sector to another as they will be specific for each company.

DESIGN THINKING’S CONTRIBUTION TO THE PRACTICAL IMPLEMENTATION OF RESPONSIBLE INNOVATION

Design thinking aims to provide a process to implement and assess an innovation and identify any potential innovative and responsible products and services that satisfy all stakeholders. The method links the required skills, know-how, and technology to address innovation as a wicked problem. The method used by Pavie and Daphne in 2015 included five stages (Fig. 1): Idea, Feasibility, Capability, Launch, and Post-Launch.

The idea phase, or the ‘philosophical issues,’ should address how to satisfy customers’ needs. The first step is to evaluate the potential social, economic, and environmental impacts and to create the first set of risk hypotheses. The analysis of potential social, economic, and environmental impacts is run in the feasibility phase, and guidelines for developing projects are used to guide the project’s further development in the right direction. The capability stage, known as ‘norms,’ verifies the second phase regarding social, economic, and environmental impacts. This phase should also specify the risk hypotheses that could differ from those created in the first stage as the project becomes more precise and more defined. The launch phase is the implementation of the chosen innovation or solution. The post-launch stage is called ‘measures,’ where the risk hypotheses are tested and verified upon the launching of the project; the purpose is to improve and facilitate control over the project’s lifecycle.

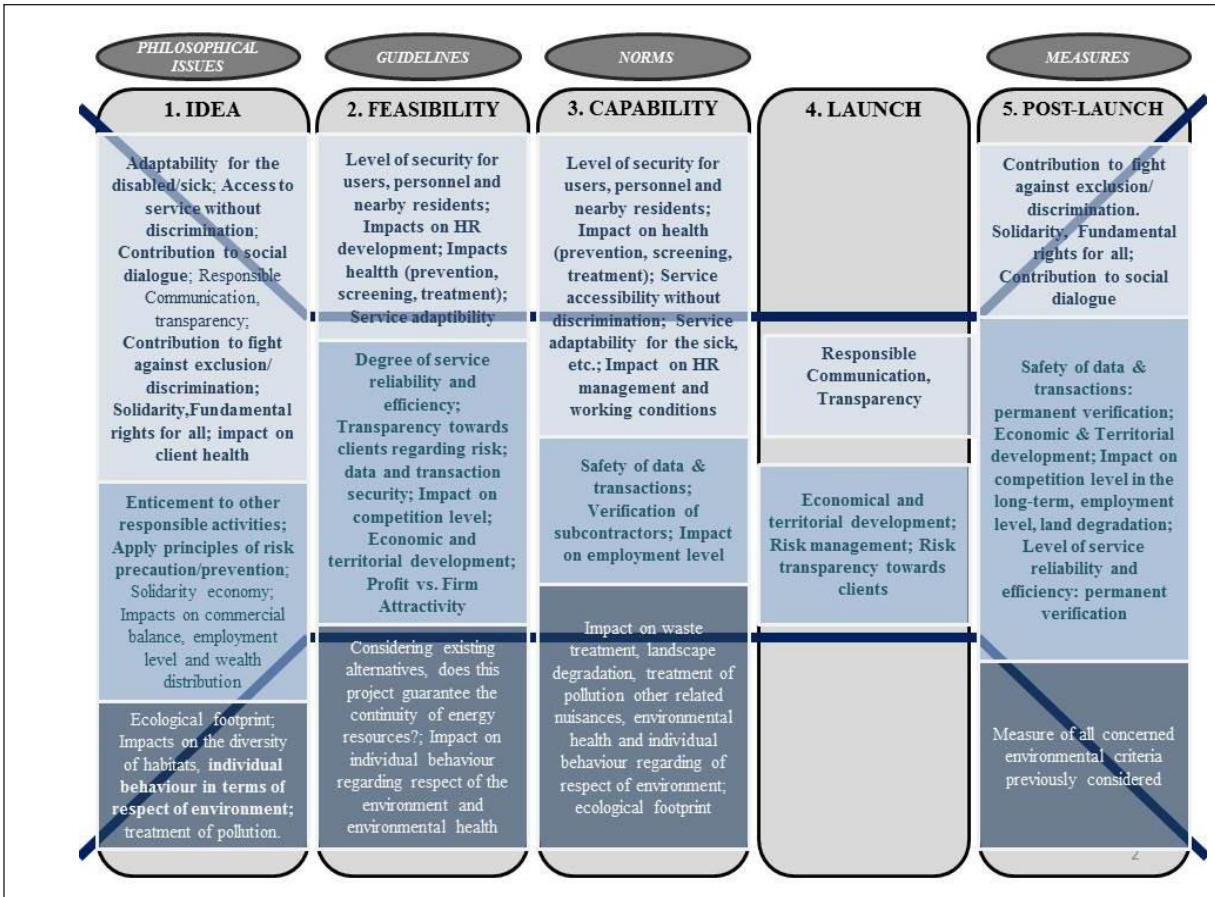


Fig. 1: Monitoring the Direct and Indirect Impacts of the Innovation

Design thinking is a structured approach to creating, developing, and testing new creative solutions using the company’s know-how to solve “wicked problems.” The primary purpose is to create better customer satisfaction, and by finding solutions, the companies will turn their challenges into opportunities (Vendraminelli et al., 2023). Design thinking depends on five phases to turn these challenges into opportunities (Zamakhsyari & Fatwanto, 2023).

The first stage is “emphasise”: the initial phase of design thinking begins with searching for and gathering information and gaining a deep understanding of the problem that needs to be solved. This stage depends on observations of the object and the problems to deepen the understanding. Empathised design is human-centred; the purpose is to understand and gain more insight into the needs of customers or end users.

The second stage, “define,” is about using the information gathered in the initial stage and turning it into data by running a deeper analysis of observations to obtain more specific problems. Similar to the first phase, the phase should always be human-centred and approachable, but it should also be understandable, actionable, and have a clear scope.

The hardest part is to have information that is not too broad or too small and not too complex or too simple.

The third stage is ideate. This brainstorming phase collects ideas for solutions to the previously predetermined problem statements. Other possible techniques could be used as the worst possible idea or brain write. It is crucial to get as many ideas as possible to find the best solution to solve the problem.

The fourth stage is the prototype. Several alternative solutions are created from the ideate stage. Different members and users will test the solutions prototypes to determine the best resolution to the problem that needs to be solved. Prototypes will be developed, reviewed, and approved or rejected based on user feedback. At this stage, the team will gain a deeper understanding of the offered solution before being tested by the end user.

The fifth and final stage is testing. In this last phase, the team should choose the best solution from the prototypes identified during the prototyping phase. The chosen solution will be tested and re-evaluated by the end user again.

The results obtained at this stage will be used to redefine the understanding of the whole process, and changes and refinements of the solution will be based on the needs of the end users.

To conclude, the design thinking method combines creativity and monitoring. Thus, the uncertainty decreases, and one of the responsibilities of companies will be to create and develop better innovations that will satisfy the users' needs.

ADVANTAGES AND DISADVANTAGES OF DESIGN THINKING

“Design thinking” is a set of tools used to create human-centred solutions, products, and services by establishing a personal connection with the end users of the solution that is being developed. The purpose is to create and maintain strong connections with users. This method's criticism is that it seems subjective and overly personal and that the design-thinking connections with customers are sometimes uncomfortably emotive and overwhelmingly affecting (Bason & Austin, 2019).

The core element of design thinking is finding and testing possible quick solutions in a collaborative task between employees, customers, and other stakeholders. This could lead to building new models or making videos of their possible solutions. This collaboration and brainstorming will be detailed, concrete, and practical. Managers should enable this practice, investing in resources and allocating time, and support the idea that it is a long-term learning process, even if failed prototypes progress. The design thinking process specifies the problems, users, and what we are trying to achieve.

DIGITAL FINANCIAL SERVICES IN BANKS

Digitalisation and technological advancements have transformed most sectors, industries, and economies by providing new opportunities. It reshaped our daily living in different and profound ways; it changed how we talk, communicate, and work. Digital financial services result from the development in digitalisation and technology; they are mainly used in banks and have transformed the form of banking services delivery to customers (Aggarwal & Patel, 2023). Digital financial services include various new services, including digital payment, internet banking, banking applications on phones and tablets, and digital payment platforms. Daily, more and more people become connected to the internet, which affects and increases

the adoption of these services. These innovations and technologies have revolutionised all sectors, especially the financial sector, enabling easier accessibility and connectivity and enabling the emergence of an efficient financial ecosystem (Abbasi & Weigand, 2017). Digitalisation increased the transparency of transactions, and improved technologies facilitated the development of customised financial services (Pazarbasioglu et al., 2020).

During the COVID-19 pandemic era, social distancing measures were critical and mandatory. This necessitated the development and adoption of fintech solutions to protect individuals' safety and ensure the continuous functioning of financial systems (Pazarbasioglu et al., 2020). On the other side, this rapid pace of development has also increased customers' expectations and shaped their needs. With the development of artificial intelligence, customers expect user-friendly, intelligent, and personalised digital offerings and solutions (Bapat, 2022). However, the user experience with digital products is radically influenced by the familiarity with and availability of the internet (Flavian et al., 2009). In 2018, Mbama and Ezepue examined the various factors that may influence the usage of digital banking services. They found that factors influencing the perception and experience of digital banking are service and functional quality, perceived value and usability by customers and their engagement, and perceived risk (Mbama & Ezepue, 2018). Another McKinsey study on factors affecting customer experiences in DFS found that the availability and quality of digital interfaces are crucial for user satisfaction. In addition, companies that can offer personalised and customised payment services will more likely receive customer recommendations (Breuer et al., 2020).

However, the complexity of these financial systems still exists and poses a risk as many individuals need more technical skills, know-how, or the required financial literacy to use these digital financial services (Bapat, 2022). Thus, the importance of user-friendly and accessible Digital Financial Services that a wide range of users could use. Although this online service offers users more flexibility in managing finances, it also increases the complexity. It could expose users to financial fraud by increasing the likelihood of making imprudent financial choices (OECD, 2018). Therefore, there is a need to improve financial literacy and educate users on utilising digital services effectively (Bapat, 2022).

The DFS sector can improve the financial inclusion of marginalised people and reduce transaction costs. It can contribute by improving customers' financial well-being and literacy, eventually driving economic growth and development.

NEED FOR TECHNOLOGY WITHIN MSME

Better technology will improve the performance of all companies, especially for Micro, Small, and medium Enterprises (MSMEs) (Gunawan & Pulungan, 2023; Meiryani et al., 2021). For prolonged survival and profitability, financial management and accounting play some of the most critical roles in business progress (Hendieh, 2023). Latifah et al. (2021) showed that innovation and accounting information systems intervene when testing the relationship between business strategies and MSME performance.

There are approximately 332.99 million SMEs worldwide that account for the majority of businesses (90%) and create more than 50% of the employment worldwide while contributing around 40% of national income (GDP) in emerging economies (World Bank, 2024). In general, SMEs need to gain a deep knowledge of accounting. Even some small businesses are running and making a profit without using or understanding accounting (Gunawan et al., 2023). For most of these owners, their business is running and performing well, while they need to grow and develop. By not using a proper financial management system, companies will commit errors and mistakes and generate losses while expecting success.

Development in technologies and, expressly, the internet has provided new opportunities for these SMEs, as they are more flexible and responsive in decision-making than the large and multinational companies. However, this flexibility and responsiveness are coupled with a need for more skills and resources in SMEs, especially regarding Information and Communication Technology (ICT) (Mohanty & Mishra, 2020). Preparing financial statements is complicated for most small businesses, so they need to pay attention to it. With financial planning and control, they will be able to know their daily and monthly turnover. With the financial statement, they can plan for further business development.

The current continuous advancement of technologies has shifted user needs and expectations in most industries and sectors. There is a growing demand for digitalisation of products and efficient and intuitive digital experiences. Moreover, this evolution of technology is constant, leading to a quick and changing development in users' needs and expectations. As users become more familiar with and understand the new digital tools and platforms, their demand for an improved user experience increases. Nowadays, users of technology expect a spontaneous, fast, and error-free use of technology (Robinson et al., 2018). Users are asking for more than just basic functionalities; they want unique and personalised experiences and expect technology to be reliable and secure. Companies and organisations must be

cautious while adopting technologies to satisfy those ever-changing needs and remain competitive in the market.

Digital transformation is “the application of technology that digitises business operations with the aim of more optimal business operations and making them much more efficient” (Mihu et al., 2023). Digitalisation in accounting can be found in transforming regular financial statements into digital ones. Financial digitalisation aims to make financial statements more efficient while recording and analysing the company's financial performance.

RESEARCH METHOD AND METHODOLOGY

The authors used qualitative research methods to explore the existing literature and identify knowledge gaps in addressing challenges connected to the reliability of digital financial information. The methodology involved an in-depth review of scholarly articles through systematic literature analysis in Fig. 1. This approach permitted the authors to comprehend the complexities associated with digital financial information systems.

A systematic literature review process permits researchers to gather, evaluate, and synthesise available literature. Contrasting traditional literature reviews, a systematic review emphasises predefined tactics to reduce bias for transparency. This methodology involves clearly defined inclusion and exclusion criteria, comprehensive search strategies across multiple databases, systematic screening of identified studies, and rigorous data extraction and analysis techniques.

This research article explored the existing literature to identify gaps in addressing the challenges associated with digital financial information reliability, facilitating evidence-based decision-making, and identifying gaps for future research.

The first stage was the identification. The authors explored secondary data using Scopus, Web of Science, and Google Scholar platforms. Consequently, using keywords the authors identified 428 articles related to the research problem. 117 articles were from Scopus, 124 from Web of Science, and 187 from Google Scholar. Next, the authors checked selected publications on duplicates, and 99 articles were eliminated from research consideration.

The second stage was screening. The authors used the following exclusion categories such as articles that do not directly address the intersection of finance and design thinking or fail to contribute meaningfully to the understanding or application of either discipline; articles that rely on outdated research, methodologies, or data,

which may not accurately represent current trends, best practices, or the evolving landscape of finance and design thinking and lastly articles lacking credibility, such as unreliable sources, lacking peer-review, or promoting

biased viewpoints without sufficient evidence or support from reputable sources. The authors screened articles on the title, consequently, 76 articles were eliminated.

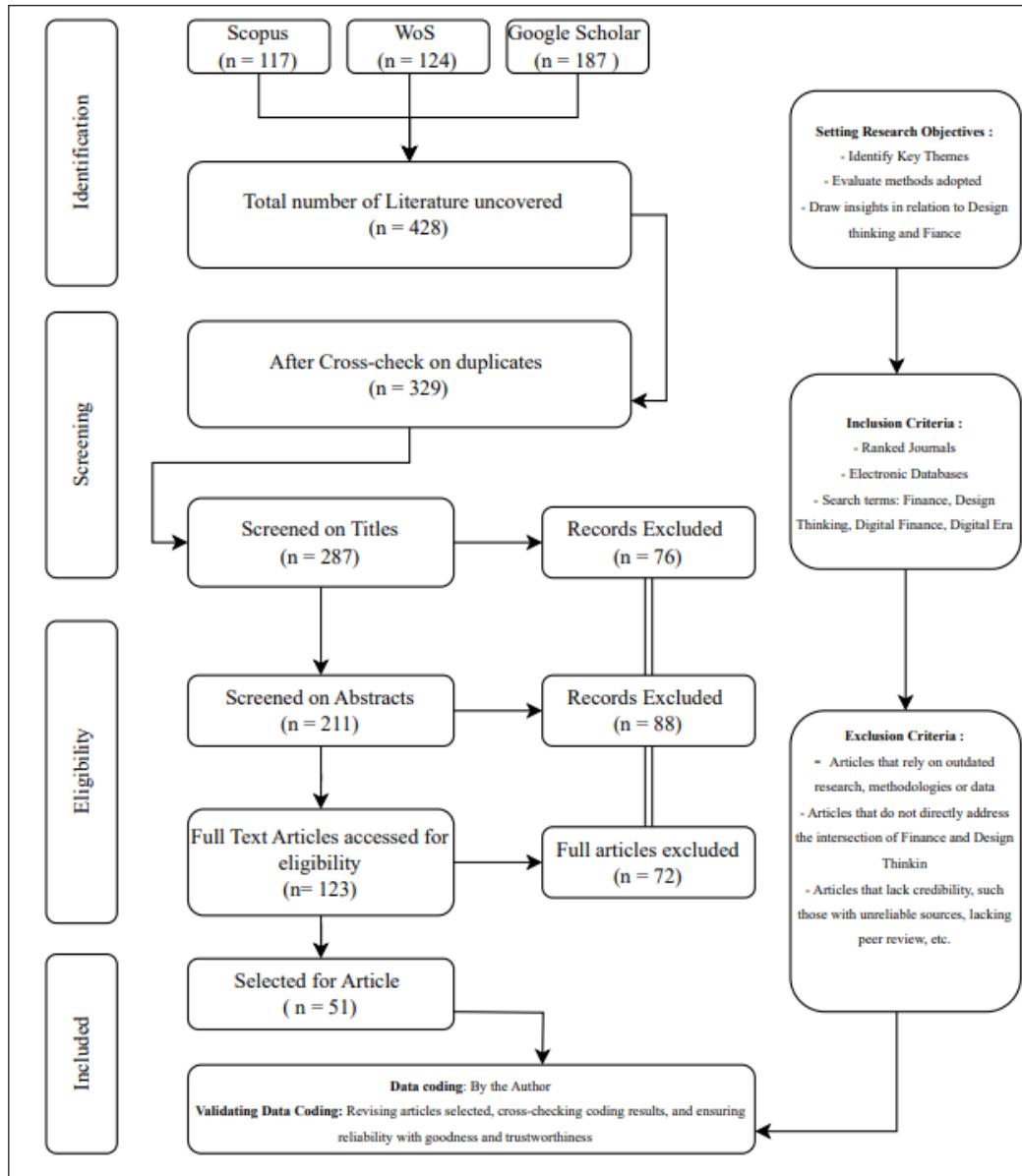


Fig. 1: Systematic Literature Review

Afterward, stage three involved checking articles on eligibility. Consequently, authors screened articles first on abstracts, where 88 articles were eliminated. Furthermore, full articles were examined, and another 72 articles were eliminated.

Lastly, the authors selected 51 eligible articles for this research. To address goodness and trustworthiness, and validate findings, the authors cross-check information.

Both authors were involved in coding the data and its transcription into valuable insights.

RESEARCH FINDINGS

After an extensive systematic literature review, the authors highlighted four key weaknesses and opportunities in the context of digital financial information reliability. The

findings are summarised in a design thinking mapping Table 1, highlighting justifications for each weakness and opportunity based on literature analysis.

The identified weaknesses and opportunities in Table 1, must be studied via quantitative research to identify relationships, statistical significance, and predictors of these characteristics.

Table 1: Weaknesses and Opportunities in Digital Financial Information Reliability

Digital Financial Information Reliability			
Weaknesses		Opportunities	
Characteristics	Justification	Characteristics	Justification
Security Vulnerabilities	The susceptibility of digital financial systems to cyber threats and hacking.	Blockchain Technology	Leveraging blockchain for secure and transparent financial transactions.
Data Accuracy	Financial data entry and processing inaccuracies lead to unreliable information.	Advanced Analytics	Utilising advanced analytics to enhance data accuracy and identify anomalies.
User Interface Challenges	Difficulty understanding and navigating complex financial interfaces, leading to errors.	User-Centric Design	Prioritising user experience in the design of financial interfaces for improved usability.
Limited Transparency	Lack of transparency in the processes involved in generating digital financial information.	Transparency Protocols	Introducing protocols that ensure transparency in generating and disseminating financial information.

DESIGN THINKING CONCEPTS IN FINANCE

Furthermore, applying design thinking to guarantee reliable financial information in the digital era requires

understanding users’ needs, involving iterative problem-solving, and leveraging technology for efficient and effective solutions. The authors, based on systematic literature analysis systematically synthesised insights showcasing the collaboration between design thinking and finance. Table 2 highlights the findings and provides the justifications.

Table 2: Navigating Design Thinking Concept in Finance (Developed by the Authors)

Navigating Design Thinking Concepts in Finance	
Stages	Justification
Empathise	Understand the financial information needs of stakeholders. Consider the impact of the digital era on data security and privacy.
Define	Clearly define the problem by synthesising the information gathered during the empathise phase. Identify key metrics and financial data.
Ideate	Brainstorm innovative solutions and consider both technological and process-oriented solutions. Encourage a collaborative approach.
Prototype	Develop prototypes and test the prototypes with a small group of users to gather feedback.
Test	Conduct usability testing and gather feedback from a more comprehensive user group. Assess the reliability, accuracy, and efficiency of the financial information provided by the prototypes.
Implement	Collaborate with IT teams to implement the chosen solution, ensuring seamless integration with existing systems.
Monitor and iterate	Implement monitoring mechanisms to track the performance of the new financial information system.
Ensure Compliance	Align the design with relevant financial regulations and compliance standards. Employ security measures to protect sensitive financial information.
User Education	Foster a culture of continuous learning to ensure users stay proficient with the evolving digital tools.

RELIABLE FINANCIAL INFORMATION

Moreover, the authors identified that in business and finance, utilising informed and reliable financial information

is fundamental for making clear decisions, ensuring transparency, and maintaining the trust of stakeholders. Table 3 illustrates crucial elements associated with informed and reliable financial information based on systematic literature analysis.

Table 3: Indicators of Reliable Financial Information

Indicators of Reliable Financial Information		
Indicators	Informed	Reliable
Data Accuracy	The financial information should be based on accurate and verifiable data.	The data should be consistently accurate over time, reflecting a commitment to precision and reliability.
Timeliness	Users should have access to financial information promptly. Delays in reporting may hinder decision-making.	Consistency in timely financial information releases trust and enables stakeholders to stay current with the organisation’s financial performance.
Transparency	Financial reports should provide a clear and transparent view of the organisation’s financial health, including disclosures about significant events or risks.	Transparency fosters confidence among stakeholders, as it demonstrates a commitment to openness and accountability.
Compliance with Standards	Financial information should adhere to accounting standards and principles, ensuring consistency and comparability.	Compliance with established standards enhances the reliability of financial information, making it easier for external parties to assess and analyse.
Technology and Security	The use of advanced technologies ensures efficient data processing and management.	Robust cybersecurity measures to safeguard financial information, preventing unauthorised access and ensuring the integrity and confidentiality of sensitive data.

To summarise, informed and reliable financial information is primary for effective decision-making, and sustaining an organisation’s credibility. By prioritising accuracy, transparency, and faithfulness to standards, businesses can ensure that their financial information is a trustworthy foundation for internal and external stakeholders.

Moreover, the authors synthesised the findings and proposed that there is a positive relationship between identified

intersections, that leads towards a successful integration of design thinking into the finance sector. Furthermore, nurturing trust in reliable digital finance information. On the contrary, quantitative research would be recommended to further study this phenomenon. Fig. 2 represents the rich picture of the intersection between Design Thinking and Finance.

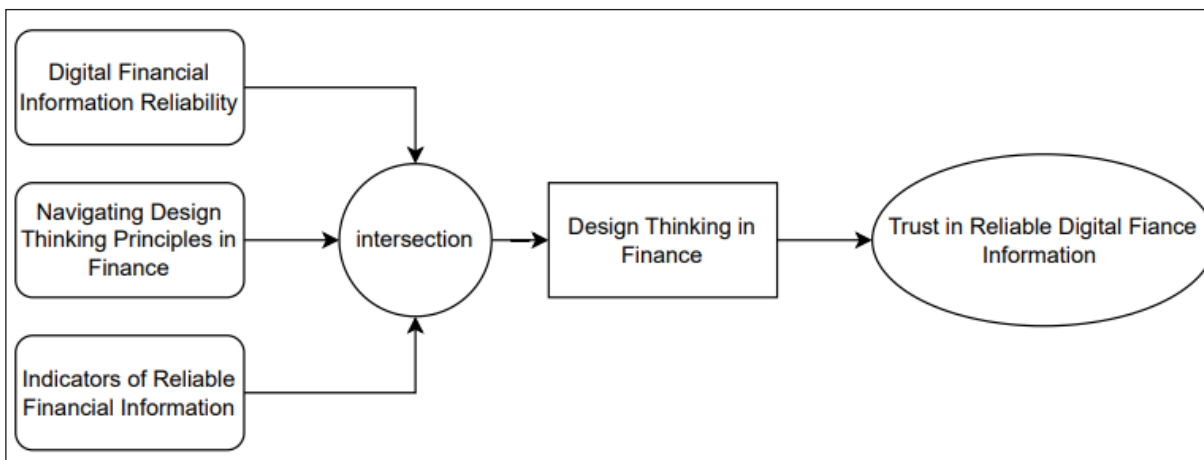


Fig. 2: Intersection of Design Thinking and Finance

CONCLUSION AND RECOMMENDATIONS

In conclusion, this research article highlighted the consequence of applying design thinking principles to understand weaknesses and capitalise on opportunities in the reliability of digital financial information. The results offer a holistic methodology to develop digital

financial systems’ security, accuracy, and transparency. The author’s recommendations include integrating blockchain technology, embracing standardised practices, and a user-centric approach to design. By agreeing on design thinking, stakeholders can collaboratively work towards creating a robust and reliable digital financial ecosystem, guaranteeing the integrity of financial information in today’s dynamic digital environment.

RECOMMENDATIONS

The authors recommend the following based on design thinking philosophy: first, empathising to understand the diverse needs of stakeholders is paramount in designing reliable financial systems. Design thinking advocates for empathy to identify and comprehend the concerns and expectations of end-users, executives, and regulatory bodies. By empathising with these stakeholders, organisations can uncover insights that shape the foundation of a resilient financial information infrastructure.

Second, define the information gathered during the empathy stage to articulate the problem at hand clearly. Defining key metrics, user personas, and the impact of the digital era on financial data security establishes a solid framework for subsequent design stages. Furthermore, Ideate. This phase encourages collaborative thinking, bringing together financial experts, IT professionals, and end-users to generate innovative ideas that address identified pain points and challenges. Moreover, develop prototypes of financial dashboards and reporting systems to test and refine potential solutions iteratively. Prototyping ensures that the proposed system aligns with user needs and organisational goals.

Test to evaluate the reliability, accuracy, and efficiency of the financial information system prototypes. Testing nurtures the proposed system to meet compliance standards and can withstand the demands of the digital environment. Implement Collaboration with IT teams is crucial to integrating the new financial information system with existing infrastructure seamlessly. Training sessions are conducted to familiarise users with the system's capabilities and functionalities. Moreover, monitoring is essential to track the performance of the implemented system. This phase ensures the ongoing reliability and relevance of the financial information system.

FUTURE RESEARCH

When applied systematically to financial information systems, design thinking offers a holistic approach to addressing the challenges of the digital era. Organisations can create financial information systems that provide reliable data and contribute to overall business continuity and resilience in the face of digital disruption. Consequently, the authors recommend conducting further studies with primary research. The necessary variables and information are already provided in this research article. Future quantitative research, and research in different sectors and countries are also required for a better understanding of the application and usefulness of design thinking while linked to financial information.

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THE USE OF BLOCKCHAIN TECHNOLOGY AND SMART CONTRACTS IN ACCOUNTING

Mehmet Kaygusuzođlu*, Yakup Durmaza*, Miraç Yücel Başera*

Abstract *This study aims to examine the use of blockchain technology and smart contracts in accounting. Accounting is one of the sectors that is suitable for the use of different technologies because of both human and system errors. Blockchain technology, which is decentralised and not affected by malicious interference by parties, is the most likely technology to be used with accounting. Compared to traditional accounting records, owing to the three-entry accounting system, records can now be followed instantly rather than for specific periods. In addition, blockchain technology, which provides benefits such as the inability of personnel and auditors to manipulate records, enables various activities, from automating business processes in accounting to creating a more transparent accounting ecosystem thanks to smart contracts. In this vein, we aim to examine the potential benefits that this approach will provide to the field of accounting by researching smart contracts.*

Keywords: *Accounting, Blockchain, Smart Contracts*

INTRODUCTION

The unstoppable advancement of technology has resulted in the development of blockchain technology, a distributed network that prevents data tampering (Bonson & Bednarova, 2019). Blockchain technology, as a revolutionary paradigm that introduces a new perspective to secure information and data sharing, is becoming increasingly popular in many fields because transactions are carried out without the involvement of third parties and are shared in a distributed system. Blockchain technology, which is employed in numerous fields, including finance, health, public services, and the military (Krichen et al., 2022), is predicted to have a major effect on accounting in terms of instant information sharing (Schmitz & Leoni, 2019). For instance, when accounting records are shared by all nodes in the network after they are published on the public blockchain, reporting and auditing can be conducted more transparently. Furthermore, as the data transfer is automated, blockchain enables financial statements to be kept up-to-date (Yu et al., 2019). Smart contracts play a key role in the emergence of blockchain technology in accounting. Smart contracts allow financial transactions to be performed automatically by means of a set of rules. Therefore, organisations' dependence on intermediary institutions and auditors is reduced, as are additional fee costs (Özdoğan & Kargin,

2018). By preventing potential data disputes in accounting, smart contracts contribute to making financial records, from receipts to documents, more accessible and verifiable. As a result of these advantages, smart contracts have become a crucial research topic in terms of cost and fraud prevention (Özkul & Alkan, 2020). This study aimed to examine smart contracts that have potential in the field of accounting.

LITERATURE REVIEW

Blockchain Technology

Blockchain is a distributed ledger technology based on cryptocurrencies that Satoshi Nakamoto introduced in his article "Bitcoin: A Peer-to-Peer Electronic Cash System" in 2008 (Ahram et al., 2017). It is a technology that maintains that transactions between network users are carried out consensually and consistently (Risius & Spohrer, 2017). In other words, blockchain refers to a distributed digital record system that consists of interconnected blocks. Transactions are introduced into the system as a new block, and because each block has an unbreakable password, external users cannot alter them (Atalay, 2018). In this regard, the following are the main characteristics of blockchain technology (Zheng et al., 2017):

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In conventional systems, transactions are approved by a central agency, such as a bank, which causes extra costs. Blockchain allows transactions to be conducted using a distributed network without the involvement of third parties.

- *Persistency* transactions in blockchain technology are verified more rapidly than those in traditional systems, and invalid transactions are rejected. It is not possible to remove or reverse transactions.

- *Anonymity* users can perform transactions on the blockchain without revealing their identity. Transactions can be held using the through system address.

In addition, the system’s transactions can be accurately monitored and confirmed.

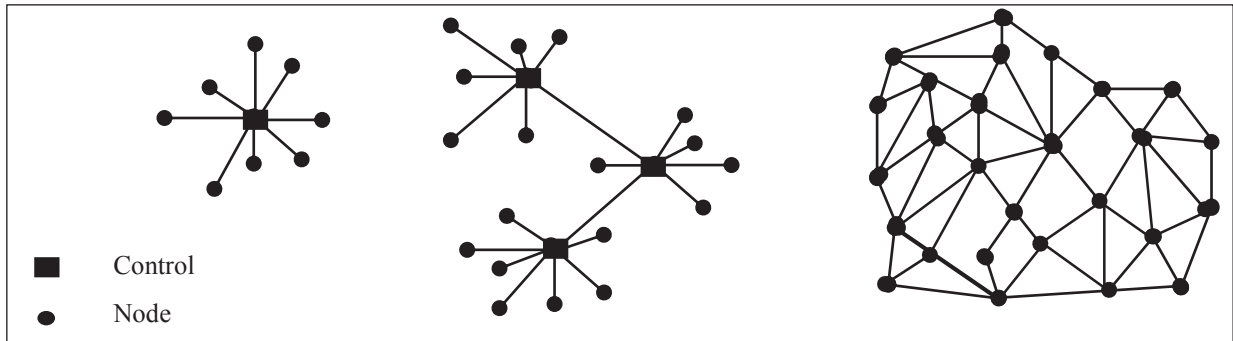


Fig. 1: Centralised, Decentralised, and Distributed Networks (Gamage et al., 2020)

In addition to its advantages, such as the ability to process transactions without the use of an intermediary and the simultaneous storage of data by stakeholders rather than through the use of a single centre, blockchain technology faces several challenges that limit its use. The following are the primary disadvantages of blockchain (Gao et al., 2018; Zheng et al., 2017):

- Scalability—the increase in the number of transactions on the blockchain may cause it to slow down. For instance, the Bitcoin blockchain can manage 7 transactions per second. Therefore, numerous transactions cannot be processed at the same time.
- Although the blockchain enables transactions to be anonymous, privacy leakage can lead to the leakage of users’ identities due to their IP addresses.
- For the majority of attacks involving transactions in the blockchain, a consensus mechanism is used. Controlling more than 50% of the miners can result in majority attacks. In this case, inaccurate and defective blocks can be included in the chain.

A blockchain is a system that allows all users to complete a transaction. However, these methods can be divided into three categories based on various criteria: public, consortium, and private (Puthal et al., 2018). These three categories are as follows:

- A public blockchain permits each user to monitor and execute transactions. Thus, it is also known as a permissionless blockchain. Through the system, mining operations are accessible to all participants.

- A private blockchain is a type of blockchain that is employed to facilitate data exchange between single or multiple organisations. Transactions and mining are conducted by people assigned by the organisation. Without an invitation, a person cannot use the system. This approach is also called a permission blockchain.
- A consortium blockchain is a partially centralised blockchain. There is no single individual responsible for verifying transactions and blocks. Instead, a set of predefined nodes decides who will perform the mining.

Blockchain Architecture

The concept of blockchain refers to the structure of data or a system. As a data structure, a blockchain is composed of connected blocks, each of which contains a representation of the previous block. Each block contains the hash of the previous block. Thus, the general and block structures of the blockchain have various components. These components are crucial for comprehending the blockchain architecture (Xu et al., 2017). The following are the key elements of the blockchain architecture (Manu et al., 2020):

- Nodes are users and computers that are part of the blockchain system (shown in Fig. 1). All have a copy of the distributed ledger on the blockchain.
- Transaction is a primary function of a blockchain system.
- Block- is the data structure used to record transactions.

- A chain is a collection of blocks organised in a particular order.
- Miner- are nodes that perform block validations.
- The consensus algorithm is a set of regulations and rules used to determine who will carry out blockchain transactions.

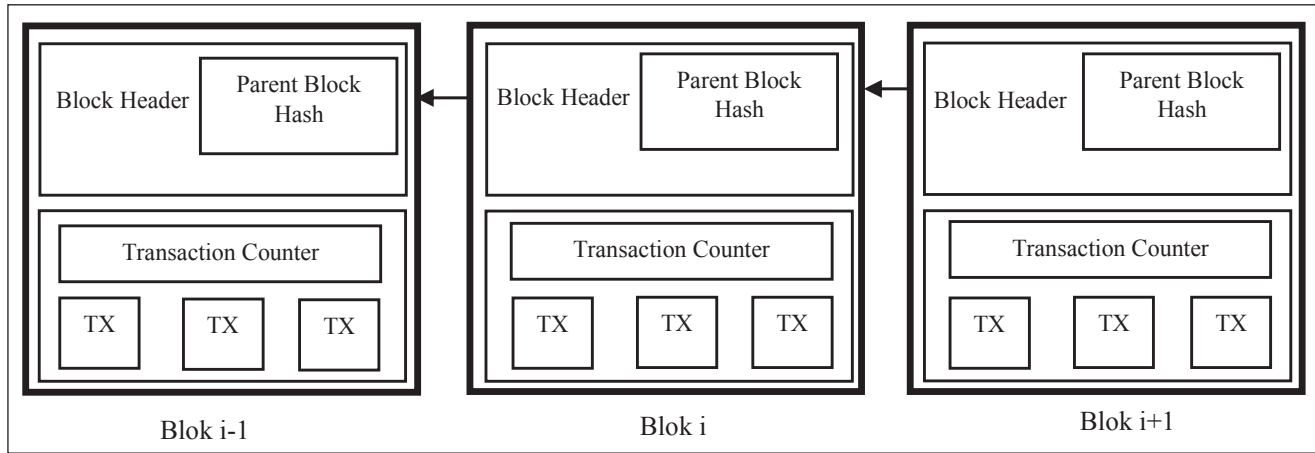


Fig. 2: A Blockchain Example with a Sequence of Blocks (Zheng et al., 2017)

Blocks are the fundamental data structure of transactions and are one of the components of the blockchain ecosystem. Blocks consist of a block header, which confirms the block’s validity, and metadata, which identifies the block (Manu et al., 2020). The ‘Genesis Block’ is the first block in the blockchain, and all subsequent blocks are dependent on it (Ismail & Materwala, 2019). Every block in a chain includes the following components (Ismail & Materwala, 2019; Zheng et al., 2017):

- The block version specifies the block validation protocol in use.
- The Merkle tree root hash algorithm is used to calculate

each transaction in the block. To create a single hash value, hash values are added together in binary. The Merkle tree value is the only hash value that was obtained.

- The timestamp indicates the creation time of the block.
- nBits- is the maximum permissible block hash value.
- The nonlinear field is a 4-byte field that begins at 0 and increases with each hash computation.
- The parent block hash: Each block includes the previous block’s hash to guarantee the distributed ledger’s immutability (Fig. 2).

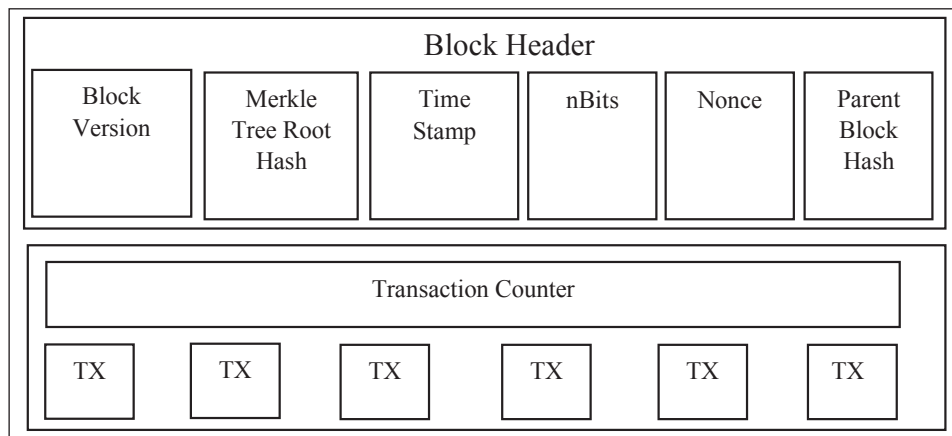


Fig. 3: Block Structure (Zheng et al., 2017)

Blockchain Applications

Although the basics of blockchain technology are based on distinct cryptocurrencies such as Bitcoin and Ethereum, over time, blockchain technology has given rise to a variety of applications (Yaga et al., 2018). The shift from blockchain 1.0 to 3.0 (Zhao et al., 2016) has resulted in the application of blockchain technology in fields as diverse as healthcare, advertising, energy, insurance, real estate, and finance (Chen et al., 2018; Puthal et al., 2018; Tama et al., 2017).

- **Finance:** Finance is one of the most effective industries for using blockchain technologies (Fig. 3). Blockchain technology simplifies business processes in the financial sector by generating reliable transaction records (Treleaven et al., 2017). Initially, cryptocurrencies were the most extensively used cryptocurrenites in the field of finance. Without the use of intermediaries, clearing and payment transactions are possible. Furthermore, many central banks have viewed cryptocurrencies as a way to broaden their portfolios (Gamage et al., 2020). In addition, the blockchain automates financial contracts and helps protocols be implemented in a more timely and cost-effective manner (Abou Jaoude & Saade, 2019).
- **Healthcare:** The health sector is among the most promising application fields for blockchain technologies. Patient records management is one of the proposed blockchain applications in the healthcare field; this method allows patients' previous medical records to be stored in a decentralised system (Puthal et al., 2018). Current recording systems pose a risk of unauthorised copying and theft of patient data (Tasatanattakool & Techapanupreeda, 2018). Nevertheless, owing to blockchain technology, patient identities and health records can be safely stored between stakeholders. Health supply chain management and remote patient monitoring are also potential blockchain applications in healthcare. While supply chain management prevents counterfeit and substandard drugs from entering the market, remote patient monitoring ensures that patients are monitored outside of the hospital (Agbo et al., 2019).
- **Insurance:** Manually executing transactions in existing insurance systems frequently increases fraud risk. Therefore, blockchain can solve many problems in the insurance industry through various applications (Raikwar et al., 2018). Consumers will be able to benefit from insurance services if the necessary conditions exist, without the need for human intervention, through smart contracts. This approach reduces operational costs and saves time (Kar & Navin, 2021). For example, AXA's travel insurance utilises contracts

to access the global air traffic database, detects flight delays of more than two hours, and provides that the consumer's compensation is paid automatically (Brophy, 2019).

- **Real Estate:** Transactions in the real estate sector are typically managed by a variety of intermediaries, including title deed organisations, notaries, and experts, making the transactions costly and time-consuming. Transactions are simplified by blockchain technology (Puthal et al., 2018). For instance, with smart contracts, property rights can be provided digitally, or the payment of the property can be made with cryptocurrencies to obtain the land registry (Konashevych, 2020). The Swedish Cadastre Chamber began using blockchain technology in 2016 to more transparently record land ownership rights. They launched a platform built on a smart contract that covers banks, sellers, buyers, insurance, and real estate authorities. The purpose of this platform is to verify the authenticity of the buyer's and seller's title documents as well as to monitor all transactions, including payments, in real-time (Pankratov et al., 2020).
- **Government:** Current public institutions depend on a centralised system and are vulnerable to manipulation and fraud. All document savings, edits, and deletions are executed through a center. Blockchain technology offers solutions to these issues (Verma & Sheel, 2022). The use of digital identity rather than traditional identity for transactions in government institutions is one of the blockchain applications. In this scenario, the individual will be able to conduct transactions at public agencies by modifying their identification in a general and private manner depending on the transaction. This approach eliminates the abuse of personal data (Abou Jaoude & Saade, 2017). Digital voting is also another possible application. Digital voting, which is based on a permanent distributed ledger, is supposed to be preventive toward occurrences such as theft and manipulation of votes in elections. It will be efficient at keeping the votes of voters safe and counting them more transparently after the election (Gamage et al., 2020).

Blockchain and Accounting

Accounting is an information system that includes the reporting, classification, summarisation, analysis, and interpretation of information on financial transactions that cause changes in an enterprise's resources and assets (Cemalcılar et al., 2002). It seeks to provide quantitative information about financial assets that helps in economic decision-making (Alexander & Nobes, 2004). As is well

known, financial statements are prepared and summarised periodically in the traditional accounting system. Auditors evaluate these prepared financial statements. Both the firm and the investors have to trust that the people who organise the financial statements provide accurate information to the auditors and that the auditors are impartial (Byström, 2019). In addition to conventional auditing methods, blockchain enables real-time auditing by providing instant transaction confirmation (Schmitz & Leoni, 2019). Dyball and Seethamraju (2022) highlighted the simultaneous recording of financial transactions on the blockchain, which allows auditors to check transactions and reports without waiting for the reporting period. Auditing is a key business process in accounting. Considering that businesses must halt commercial transactions due to auditor resignation, blockchain has the potential for continuous and comprehensive auditing (Pimentel et al., 2020). While the suspicion that the blockchain-based accounting system will disrupt the auditing industry is unfounded, it is predicted to assist in the auditing of financial records with less error and fraud (Tan & Low, 2019). Thus, blockchain technology presents a reliable means of monitoring trade and financial assets (Abida, 2024).

In accounting, blockchain technology, which ensures that transactions are recorded on a permanent and interlocked system rather than separately, can both prevent irregularities in records and reduce control costs by providing convenience in routine repetitive transactions (Bonson & Bednarova, 2019). The double-entry system of accounting is becoming triple-entry accounting as a result of blockchain. The triple-entry accounting system consists mainly of a debit recording, a credit recording, and a cryptographic signature that verifies the transaction’s validity. All the data distribution, recording, and transaction verification steps are carried out with the assistance of impartial intermediaries (Garanina et al., 2022). Because all the transactions in the triple entry system are available in the distributed ledger, a new generation of “glass organizations” is formed, and users can access financial information without waiting for the publication of the enterprises’ end-of-period financial statements (Spano et al., 2022). The triple-entry accounting system, which is based on a distributed ledger structure, led to the concept of the ‘Worldwide Ledger (WWL)’. In this sense, all the financial information of the organisations is published at the international level and becomes accessible. Furthermore, by providing transparent access to records, WWL assists all partners and regulatory authorities in reviewing and understanding financial reports without the need for technical knowledge (Kablan, 2019). According to Centobelli et al. (2022), the information invariance feature of the triple-entry accounting system helps stakeholders such as banks, tax institutions, and managers confirm the

consistency of financial transactions. In a different scenario, blockchain is expected to be effective at detecting and preventing tax evasion at the national and international levels (Rindaşu, 2019). Silva et al. (2021) focused on ‘Distributed Consensual Accounting Records’ (DCAR). Accounting records in DCAR are recorded in bulk after they have been approved by nodes (supplier, customer, supervisory, and administrative authorities) and thus are based on the parties’ holistic trust rather than central trust. The fact that accountants play a significant role in the transition from traditional accounting to blockchain must also be considered (Fig. 4). In this process, accountants must have some knowledge of blockchain to carry out various tasks, such as document recording and financial statement preparation (Yu et al., 2019).

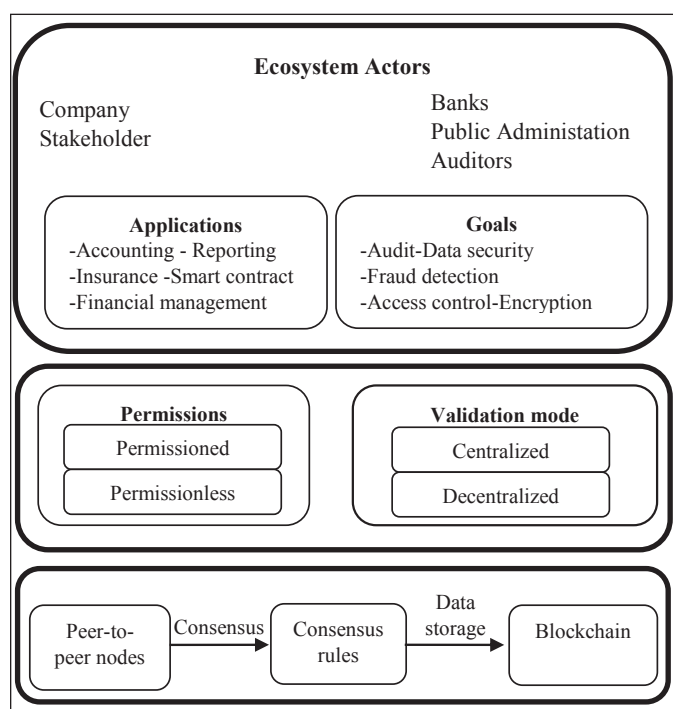


Fig. 4: Blockchain Architecture in Accounting from an Ecosystem Perspective (Centobelli et al., 2022)

Smart Contracts

Smart contracts are the most crucial factor in the rise of blockchain technology in accounting (Fullana & Ruiz, 2021). Because accounting records are stored in an unalterable chain and audit procedures can be conducted independently by eliminating the need for auditors, smart contracts are needed (Garanina et al., 2022). Research by Fortune 500 companies showed that companies will spend approximately \$20 billion per year on smart contracts and blockchain technologies. The notion that smart contracts

fundamentally alter the way fraud is prevented is one of the key causes of this (ISACA, 2022). A smart contract aims for stakeholders to execute a specially coded agreement on the blockchain (Krichen et al., 2022). In other words, smart contracts are based on any contract terms being converted into computer codes and stored in the blockchain until the parties cancel or the contract terms are completed (Ozdogan & Kargin, 2018). For instance, Ahmet and Mehmet have integrated their commercial agreements into blockchain systems in the form of smart contracts. In this agreement, smart contracts help in the automatic fulfilment of both parties' obligations. The system will automatically pay Mehmet the \$100 that Ahmet will pay him once the necessary conditions are met. In this case, because of triple-entry accounting and smart contracts, receivable and payable accounts, as well as payment transactions, will be automatically recorded in the system in an accurate and up-to-date manner (Suekinci & Catikkas, 2020). As shown

in Fig. 5, the supplier first sends the product catalogue with product information (price, quantity, etc.) to the buyer via the blockchain network. This catalogue is stored on the blockchain to verify the supplier's trustworthiness. The buyer then sends her order using the blockchain, providing information such as product quantity and payment date, and a purchase contract is created without the intervention of a third party. Following that, the supplier negotiates a smart contract with the carrier to deliver the products to the buyer via blockchain, with terms such as shipping fee, product capacity, and delivery date. As a result, if the clauses in smart contracts are completed, payments from the supplier to the carrier and from the buyer to the supplier are made automatically (Zheng et al., 2020: 475–476). Smart contracts can help achieve significant savings in transaction costs in this direction. The following are the main advantages of smart contracts (Manu et al., 2020):

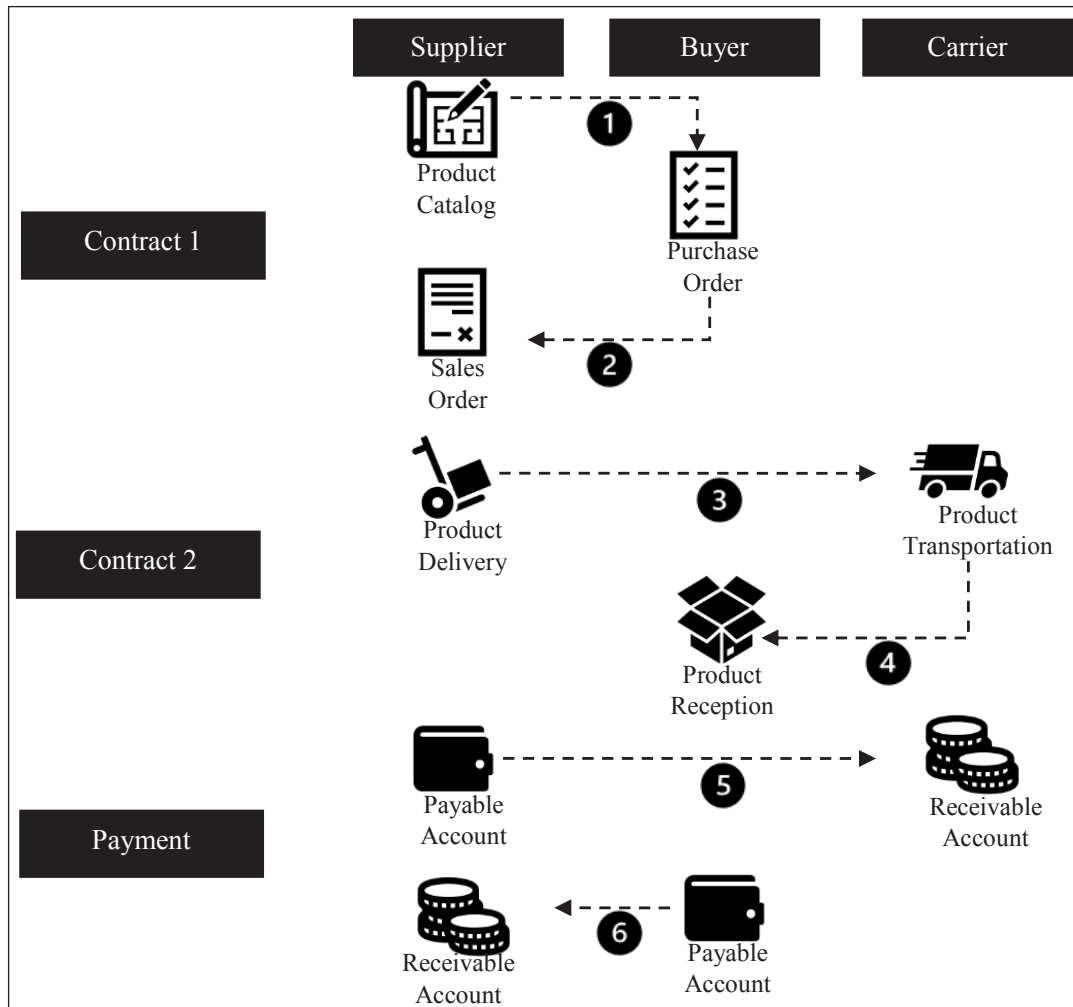


Fig. 5: An Example of a Smart Contract Between a Buyer and a Supplier

- Reduced costs by eliminating the need for intermediaries.
- It accelerates execution by allowing the contract to be executed automatically.
- Remove intermediaries and reduce the cost of money transfers.
- It creates a transparent ecosystem.
- Contract clauses cannot be changed because they are encrypted on the blockchain.

Accounting records and financial statements can be generated automatically using smart contracts. The automatic generation of financial statements diminishes errors and delays in reporting processes (Yu et al., 2019). Moreover, smart contracts that automatically follow accounting regulations and standards are expected to automate tax returns (Cakır & Ozcan, 2021; Ozkul & Alkan, 2020). Smart contracts make it easier for managers to keep track of business accounting records and business processes. In addition to payments, bank transactions, collection, etc., it facilitates the instant presentation of accounting data to creditors, stakeholders, managers, and auditors. Furthermore, establishing a transparent accounting ecosystem by providing verifiable data to investors and business partners is thought to be effective (Kazak & Erdemir, 2020). Smart contracts involve the exchange of money between parties as well as accounting information within the organisation. Furthermore, because accounting information is instantly shared between parties, real-time access to reports is permitted (Centobelli et al., 2022). Spano et al. (2022) highlighted that real-time reports shift power away from company management and toward shareholders and stakeholders. In addition, smart contracts help detect suspicious transactions in records, monitor enterprises' financial status, and facilitate enterprises' compliance with market regulations (Liu et al., 2019). In summary, smart contracts improve the traceability and transparency of accounting policies, as well as the comparability of accounting data (Yu et al., 2019). Furthermore, smart contracts can regulate accounting records by detecting inventory and asset damage. Therefore, when an enterprise's products are shipped with special sensors, these sensors report any damage to the products, and these damaged products are recorded in accounting records through smart contracts (Silva et al., 2021).

CONCLUSION

Research has shown that blockchain technology has a wide range of potential applications, ranging from digital voting in election processes (Gamage et al., 2020) to storing patient medical records in a decentralised network (Puthal et al.,

2018). In terms of accounting, blockchain technology seems promising because it can benefit businesses in financial business processes, and these processes can be programmed and automated, particularly with the help of smart contracts. Therefore, smart contracts will not only provide more verifiable financial statements for managers but also assist in obtaining more transparent and reliable data for investors.

Accounting records that are automatically updated or triple-entry accounting systems are still in development. This situation highlights the issues with blockchain technologies that must be addressed in the accounting field, as well as many other fields. To use the triple accounting system, for instance, the parties must agree. Only one of the parties' attempts to integrate blockchain technology will impede the use of many applications (Ozkul & Alkan, 2020). Furthermore, the drop in the workforce expected as a result of the shift to blockchain technologies may result in the layoff of many accounting personnel. This demonstrates that employment is a barrier that must be resolved. Government legislation on the use of blockchain technologies will also be a barrier to its adoption (Dogan & Ertugay, 2019).

It is recommended that future research on blockchain applications and smart contracts focus on potential issues that may hinder their use. The fact that blockchain technology saves labour and time in accounting can cause accountants and auditors to focus on data mining and in-depth analysis. In that way, employees can become more aware of and skilled in blockchain technologies. Given the adoption of blockchain technology by consumers, qualified accountants will be in higher demand. Accountants who are knowledgeable about blockchain technology can encourage businesses to use it by providing them with information about it. As a result of the growing popularity of blockchain, accountants must expand their knowledge and skills to meet client demands (Schmitz & Leoni, 2019). Given the correlation between financial literacy and investor decision-making (Shroff & Paliwal, 2024), it is crucial for businesses and customers to possess a solid grasp of blockchain literacy to facilitate the seamless adoption of blockchain technology. Because, the correlation between self-efficacy and technology acceptance (Aggarwal & Patel, 2023) suggests that, during the adoption of a new technology, both knowledge and experience play a significant role alongside the opportunities presented by the technology.

In the literature, discussions about whether blockchain applications disrupt the accounting profession continue. Therefore, more applied research will be beneficial in terms of gaining a thorough understanding of blockchain technologies in accounting. Although theoretical information is useful in determining the system's advantages and disadvantages, applied research is required to examine how

the blockchain works in accounting. It is hoped that studies conducted jointly by academics and businesses will be more constructive in this regard.

CRediT Authorship Contribution Statement

Mehmet Kaygusuzoğlu: Conceptualisation, Methodology, Software, Visualisation, Validation, Investigation, Data curation, Writing – original draft. *Yakup Durmaz:* Conceptualisation, Data curation, Writing – original draft. *Miraç Yücel Başer:* Conceptualisation, Writing – review & editing.

Data Availability

Data will be made available on request.

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FACTORS AFFECTING THE ACCEPTANCE OF SELF-SERVICE TECHNOLOGIES IN THE INDIAN BANKING SECTOR

Rajeev Sirohi*, Umar Bashir Mir**

Abstract India has witnessed a surge in the acceptance of Self-Service Technologies (SSTs) in the banking sector, driven by events such as the 2014 demonetisation and the global COVID-19 pandemic, as well as government encouragement. This study delves into the determinants shaping the acceptance of SSTs in the Indian banking landscape. Utilising the Technology Acceptance Model (TAM) as a foundation, the theoretical model encompasses perceived ease of use, perceived usefulness, perceived self-efficacy, perceived risk, and perceived social influence as independent variables. The dependent variable under scrutiny is customers' behavioural intention towards SSTs in banking in rural India. Employing SEM using Smart PLS4, the study analyses data from 320 rural banking customers in India. The results highlight the significant impact of perceived ease of use and perceived usefulness on customers' behavioural intention towards SSTs in banking. However, the study does not find support for the moderating effects of gender and marital status on customers' behavioural intention towards SSTs in banking. Further exploration of path coefficient variances demonstrated that the impact of perceived ease of use and perceived usefulness on customers' behavioural intention towards SSTs in banking was more pronounced among males and married people. The insights garnered from this study offer valuable implications for financial institutions, consumers, businesses, and researchers aiming to promote SSTs in the Indian banking system.

Keywords: Self-Service Technology, Technology Acceptance Model, Behavioural Intention, Structural Equation Modelling, Banking

INTRODUCTION

Self-service technologies (SSTs) are defined as “technological interfaces that enable users to avail services without direct employee intervention” (Meuter et al., 2000). These high-tech, low-touch options have become integral in reshaping traditional banking services, with categories such as Automated Teller Machines (ATMs), electronic cash transfers, internet banking, e-wallet, and unified payment interface (UPI), playing pivotal roles in service delivery (Curran et al., 2003; Fahad & Shahid, 2022; McPhail & Fogarty, 2004; Meuter et al., 2000). Customers may now perform transactions around the clock at their convenience thanks to SSTs (Sum Chau & Ngai, 2010). SST is a win-win for banks and customers. While banks have attained high efficiency, reduced cost, and higher profitability, customers have become less reliant on employees to operate their accounts and perform transactions (Montazemi & Qahri-Saremi, 2015; Rawashdeh, 2015; Saxena et al., 2016). The advancements in technology have enabled banks to provide better customer services, which ultimately impact customers to use such technologies (YuSheng & Ibrahim, 2019).

Factors influencing customers' behavioural intention towards online banking in India have been a subject of interest in recent research. Research has explored factors influencing SST acceptance, revealing that consumers who perceive technology as a superior, user-friendly, and enjoyable service alternative are more likely to embrace it (Changati & Kansal, 2019; Dabholkar & Bagozzi, 2002; Weijters et al., 2007). Studies have highlighted various factors impacting the adoption of online banking services among Indian customers. Trust, perceived ease of use, perceived usefulness, and convenience have been identified as significant factors influencing customers' behavioural intention toward online banking (Hossain et al., 2020; Pahuja & Virk, 2012; Yoon & Barker Steege, 2013). Furthermore, demographic factors, technological anxiety, and the desire for less personnel interaction impact SST acceptance (Curran et al., 2003; Montazemi & Qahri-Saremi, 2015).

Prior studies on the adoption of SSTs have mostly looked at developed economies, with limited studies specifically exploring developing economies like India (Chaouali et al., 2016; R. F. Malaquias & Hwang, 2016). Existing studies in

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India are often conducted in metropolitan cities, potentially overlooking the unique cultural and socio-economic factors that shape technology acceptance in rural India. Despite the benefits of SST, the acceptance of SSTs is still low, especially in the rural parts of India wherein it is most needed.

This study aims to bridge a knowledge gap by examining the factors that drive customer acceptance of SSTs within the rural Indian banking sector, along with the influence of demographic characteristics. The focus will be on two key banking SSTs: ATMs and internet banking.

The insights derived from this study aim to assist financial institutions in crafting effective marketing strategies to enhance SST acceptance in banking in rural India. Widespread SST adoption in rural areas can empower individuals with convenient access to financial services, fostering financial inclusion and economic development.

The document’s forthcoming sections are arranged as follows: In Section 2, the conceptual model is produced composed with research hypotheses. The methodology and development of the measuring instruments are described in depth in Section 3. The study’s findings are emphasised in Section 4. Subsequently, Section 5 presents the discussion. Section 6 deals with implications and Section 7 tackles constraints and proposes avenues for future investigation. Lastly, Section 7 provides the conclusion.

THEORETICAL BACKGROUND AND HYPOTHESIS DEVELOPMENT

Previous research in various contexts has explored customer acceptance of SSTs in banking, employing diverse behavioural models (Alalwan et al., 2018; Kaur & Kaur, 2021; Martins et al., 2014; Shankar et al., 2020). Studies

like Martins et al. (2014) identified key factors influencing Internet banking adoption: anticipated benefits, perceived effort, and social influence. Additionally, Riffai et al. (2012) found factors like enjoyment and website design impacting user intentions in Oman. Al-Somali et al. (2009a) and Chiou & Shen (2012) highlighted the crucial role of perceived ease of use in shaping both positive attitudes and perceived usefulness towards Internet banking. Similar research on mobile banking suggests the importance of convenience, security, self-confidence, and social influence (Arora & Kaur, 2018; Giovanis et al., 2019; Koksai, 2016; Tran & Corner, 2016; Zhang et al., 2018). Drawing upon the Technology Acceptance Model (TAM) as a foundation, Davis et al. (1989) focus on understanding SST adoption in the banking sector. TAM suggests that perceived usefulness and perceived ease of use are core factors influencing user intention.

Building upon TAM’s foundation, this study incorporates additional constructs:

- *Perceived Self-Efficacy*: Reflects individuals’ confidence in using SSTs effectively (Venkatesh & Davis, 2000).
- *Perceived Social Influence*: Captures the extent to which individuals believe their social circle expects them to use SSTs (Venkatesh et al., 2003).
- *Perceived Risk*: Considers the potential negative consequences associated with using SSTs, such as security concerns (Walker et al., 2002).

Furthermore, this study investigates the potential influence of demographic factors like gender and marital status on the relationships between these constructs and user intentions. Fig. 1 visually depicts the extended TAM framework utilised in this research.

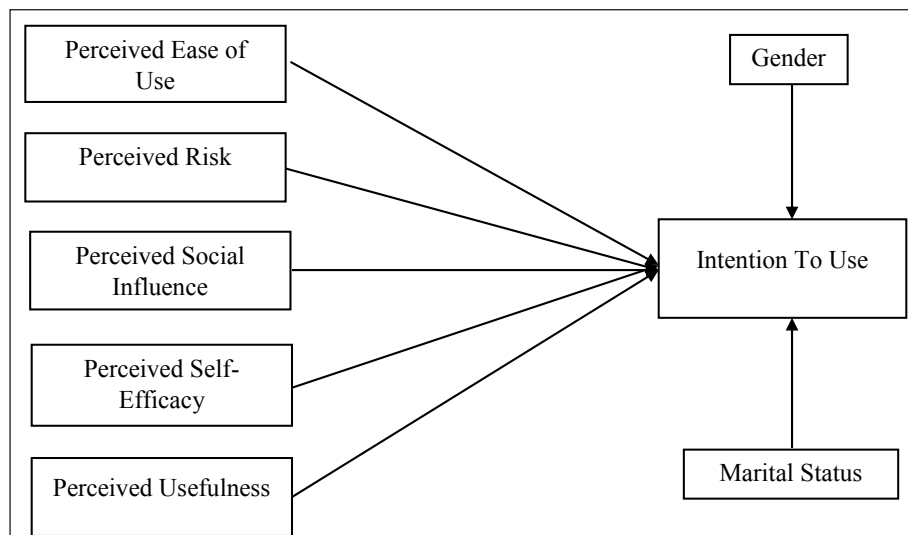


Fig. 1: Proposed Theoretical Model

Behavioural Intentions and Potential Determinants of SSTs Usage in Banking

This section explores the concept of behavioural intentions and investigates potential factors influencing customers' willingness to accept SSTs in banking. Behavioural intentions represent individuals' interest and likelihood to engage in a specific behaviour, acting as a bridge between attitudes and actual behaviour (Fishbein, 1975).

Perceived Ease of Use

As highlighted by Koenig-Lewis et al. (2010), individuals with higher levels of computer literacy tend to adapt to new technologies quickly and experience fewer difficulties. Building upon Davis et al. (1989) work on the cognitive trade-off process, where individuals weigh the effort required against the perceived benefits of technology, this study proposes that perceived ease of use can positively influence users' intentions to utilise SSTs. This is further supported by empirical evidence in Internet banking research (Al-Somali et al., 2009b; Cheng et al., 2006). Following this line of research, the following hypotheses is put forth: *H1: Customers' intention to utilise SSTs in banking is positively impacted by their perception of ease of use.*

Perceived Risk

Perceived risk refers to the uncertainty people experience regarding potential negative consequences associated with a particular service (Bauer & Cox, 1967). As noted by Peter and Ryan (1976), the anticipation of potential losses can act as a barrier to adopting new behaviours. Studies have shown that customers often perceive online transactions, especially those involving money, as inherently risky (Hoffman et al., 1999; Jarvenpaa et al., 2006). This risk perception has been recognised as a reason hindering the acceptance of electronic services, particularly in the financial sector (Koller, 1988; Pavlou & Pavlou, 2001).

Following this line of research, the following hypotheses is put forth:

H2: Customers' intention to utilise SSTs in banking is positively impacted by their perception of risk.

Perceived Social Influence (PSI)

Individuals are susceptible to social influence from their social networks, including family, friends, peers, and superiors in banking (López-Nicolás et al., 2008). According to Venkatesh et al. (2003), social influence is the degree to

which people think that other people anticipate them using a new technology. This construct has been established as a significant predictor of behavioural intentions (Chong et al., 2012; Venkatesh et al., 2012). Additional research indicates that consumers can have a significant impact on raising awareness and influencing others' plans to use technology (Alalwan et al., 2015, 2016). Research by Kim et al. (2011) demonstrates that social influence is a key driver of individuals' adoption of Internet banking.

Following this line of research, the following hypotheses is put forth:

H3: Customers' intention to utilise SSTs in banking is positively impacted by their perception of social influence.

Perceived Self-Efficacy

TAM suggests that self-efficacy and perceived ease of use are related (Venkatesh & Davis, 1996). When individuals have prior experience with technology, their confidence in their technological abilities contributes to their perception of ease of use for new technologies. According to studies, usage intention and behaviour of SSTs are directly impacted by perceived self-efficacy (Meuter et al., 2005). Hence the following hypotheses is put forth:

H4: Customers' intention to utilise SSTs in banking is positively impacted by their perception of self-efficacy.

Perceived Usefulness

Perceived usefulness refers to the benefits and advantages, like convenience, customisation, accessibility, efficiency, and time-saving benefits, individuals expect to gain from using innovative channels like SSTs (Venkatesh et al., 2003). People who believe benefits of technology are more likely to adopt it for banking activities (Baptista & Oliveira, 2015). Numerous studies have established perceived usefulness as a key factor influencing individuals' decisions to adopt information systems and technologies (Dwivedi et al., 2019; Rana et al., 2017), particularly in the context of Internet banking (Abushanab et al., 2010).

Hence the following hypotheses is put forth:

H5: Customers' intention to utilise SSTs in banking is positively impacted by their perception of usefulness.

Demographics Characteristics

Safeena et al. (2014) concluded that the TAM model was impacted by demographic factors such as gender and age, as well as perceived benefits and social influence. Al-Somali

et al. (2009a) state that education has a significant impact on Saudi Arabians' perceptions of the usage of Internet banking. The moderating role of gender in the relationship between mobile banking attitude and convenience of use was highlighted by Chawla and Joshi (2018). The favourable correlation between trust and attitude towards mobile banking is, however, moderated by age. Drawing on extant literature, the next conjectures are put forth:

H6: Customers' inclination to employ SSTs in banking is significantly correlated with their gender.

H7: Customers' inclination to employ SSTs in banking is significantly correlated with their marital status.

RESEARCH METHODS

The primary objective of this study was to discern factors influencing customer acceptance of SSTs in the banking sector in rural India and explore how demographic characteristics influence this relationship. To achieve this, a research model was devised based on existing literature and subsequently assessed using data collected through a survey questionnaire. The following outlines the research methods employed.

Measures and Questionnaire Development

The study incorporates six constructs and their respective items, drawing from prior studies. The number of items per construct is 3, resulting in an instrument comprising 18 items, excluding demographic questions. The scales, developed by (Venkatesh et al., 2012), were used to measure perceived usefulness, perceived ease of use, perceived social influence, and Behavioural intention. Three items used to measure perceived risk were borrowed from (Slade et al., 2015). Perceived self-efficacy was measured using 3 items from (Venkatesh & Davis, 2000). A five-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree") was used to record the responses from the respondents.

Sample and Data Collection

The participants were randomly selected from individuals visiting banks situated in convenient locations across rural areas of North India. The study aimed for a minimum of 320 respondents to answer questions related to the two most widely used SSTs, i.e., ATMs and online banking, a goal that was successfully attained. Each respondent was briefly informed about the context of the study and the relevance of their opinion before filling out the questionnaire. Most

responses were obtained from western Uttar Pradesh in India, with approximately 54 percent of respondents being adult students, chosen for their accessibility and targeting feasibility.

Data Analysis

This section describes the statistical methods used to analyse the data. We used a variant of Structural Equation Modelling (SEM) called Partial Least Squares path modelling (PLS-PM) to assess our research model (Ringle, 2005). This software, specifically SmartPLS 4.0, was chosen because PLS-PM is well-suited for analysing complex models with many variables, even with a moderate sample size (Hair et al., 2011). Additionally, PLS-PM is less sensitive to certain data assumptions than other SEM methods, making it a good choice for our study.

RESULTS

The survey data underwent analysis using SmartPLS version 4. Confirmatory factor analysis (CFA) was employed to assess convergent and discriminant validity, as well as reliability. Subsequently, a partial least square approach within SEM was utilised to evaluate the proposed hypotheses, and a multigroup analysis was conducted to examine the moderating effects of gender and marital status.

Measurement Model Analysis

The examination of the measurement model serves to uncover the relationship between observed or measured variables and latent variables within a specified investigation (Hair et al., 2019). This study gathered various measuring items with numerical values from the study's respondents to assess latent variables. Subsequently, the reliability and validity of these items are evaluated. The proposed model was tested using SmartPLS version 4.0 and the partial least square structural equation modelling (PLS-SEM) technique (Sarstedt et al., 2022).

Convergent Validity and Reliability

The outcomes of the measurement model analysis are presented in Table 1. To establish construct reliability, Cronbach's alpha (CA) scores above 0.70 and composite reliability (CR) values exceeding 0.70 were utilised (Hair et al., 2019). Construct reliability was affirmed as all latent constructs exhibited Cronbach's alpha values and CR values surpassing 0.70. Subsequently, for convergent validity, factor loading (FL) values surpassing 0.708, and average variance

extracted (AVE) values exceeding 0.50 were employed (Hair et al., 2019).

The analysis confirmed construct reliability, with all latent constructs having Cronbach's alpha values and CR values exceeding 0.70. Factor loading values, all-surpassing

0.70, were deemed acceptable. Additionally, the AVE values, exceeding 0.50, indicated that each latent construct accounted for 50% or more of the variance in the observable variables, on average. These results affirmed the convergent validity of the measurement model.

Table 1: Results of Measurement Model Analysis

Latent Construct	Measured Variable	Standardised Factor Loading (CFA)	Cronbach's Alpha >0.70	Composite Reliability >0.70	AVE >0.50
Perceived ease of use	Item1	0.950	0.924	0.952	0.868
	Item2	0.914			
	Item3	0.931			
Perceived usefulness	Item13	0.870	0.830	0.898	0.745
	Item14	0.886			
	Item15	0.833			
Perceived self-efficacy	Item10	0.983	0.981	0.987	0.963
	Item11	0.979			
	Item12	0.983			
Perceived risk	Item4	0.988	0.908	0.943	0.846
	Item5	0.892			
	Item6	0.875			
Perceived social influence	Item7	0.969	0.870	0.913	0.781
	Item8	0.745			
	Item9	0.921			
Behavioural intention	BI1	0.914	0.804	0.883	0.718
	BI2	0.893			
	BI3	0.723			

Discriminant Validity

Discriminant validity ensures the distinctiveness of each latent variable from others. The Fornell and Larcker (1981) criterion was employed, comparing the correlation coefficients of the constructs with the corresponding square root of AVE values. As depicted in Table 2, all square roots of AVE values (diagonal elements in bold) surpassed the inter-construct correlation coefficients (off-diagonal elements).

The Heterotrait-Monotrait Ratio (HTMT), measuring real correlations across components, was employed as a discriminant validity measure in the PLS-SEM approach (Hair et al., 2019). Discriminant validity was established when the HTMT value was below 0.9 study (Ali et al., 2016; Voorhees et al., 2016). These results indicated that each latent construct was distinctive, affirming the presence of discriminant validity (Table 3).

Table 2: Results of Discriminant Validity - Fornell-Larcker Criterion

Latent Variables	Behavioural Intention	Perceived Ease of Use	Perceived Risk	Perceived Self-Efficacy	Perceived Social Influence	Perceived Usefulness
Behavioural Intention	0.848					
Perceived ease of use	0.708	0.932				
Perceived risk	-0.439	-0.576	0.920			
Perceived self-efficacy	0.147	0.185	-0.053	0.981		
Perceived social influence	-0.079	-0.086	0.205	-0.009	0.884	
Perceived usefulness	0.722	0.882	-0.519	0.196	-0.083	0.863

Table 3: Results of Discriminant Validity - Heterotrait-Monotrait Ratio (HTMT)

Latent Variables	Behavioural Intention	Perceived Ease of Use	Perceived Risk	Perceived Self-Efficacy	Perceived Social Influence	Perceived Usefulness
Behavioural Intention						
Perceived ease of use	0.801					
Perceived risk	0.485	0.628				
Perceived self-efficacy	0.165	0.187	0.051			
Perceived social influence	0.115	0.100	0.239	0.019		
Perceived usefulness	0.854	0.884	0.599	0.208	0.111	

Analysis of the Structural Model and Hypothesis Testing

The evaluation of the structural model becomes pertinent once the integrity of the entire measurement model has been established (Hair et al., 2019). This analysis is crucial for hypothesis verification, determining whether the stated hypotheses, indicating the relevance of relationships, are accepted or rejected (Byrne, 2013). In this study, a bootstrapping approach was employed with a subsample of 1000 for estimating the structural model (Sarstedt et al., 2022). The path coefficients (beta), t statistics, and corresponding p-values are presented below. A statistically significant t-value in two-tailed testing lies outside the range of -1.96 and +1.96, with a p-value less than 0.05 (Byrne, 2013). The results of the structural model analysis are detailed in Table 4.

Byrne (2013) recommends that the Normed Fit Index (NFI) should exceed 0.90, and the Standardised Root Mean Square Residual (SRMR) should be below 0.09 for model fit. The PLS analysis in this study produced SRMR (0.059) and NFI (0.92), meeting the suggested criteria. However, it's crucial to note that certain model fit metrics such as χ^2 , GFI, CFI, and RMSEA, not considered by PLS-SEM, were not taken into account (Hair et al., 2019).

The findings indicate that both perceived usefulness ($\beta = 0.435$, $t = 3.418$) and perceived ease of use ($\beta = 0.301$, $t = 2.530$) significantly and positively influence the customers' behavioural intention towards SSTs banking at $p < 0.01$ and $p < 0.05$, respectively. Conversely, the influences of perceived risk ($\beta = 0.038$, $t = 0.501$), perceived social influence ($\beta = 0.010$, $t = 0.158$), and perceived self-efficacy ($\beta = 0.004$, $t = 0.069$) were found to be statistically insignificant. Thus, hypotheses H1 and H5 were supported.

Table 4: Results of Structural Model Analysis

Hypothesis	Paths	Beta	T Statistics	P Values	Results
H1	Perceived ease of Use -> Behavioural Intention	0.301	2.530	0.012*	Significant
H2	Perceived risk -> Behavioural Intention	-0.038	0.501	0.617	Insignificant
H3	Perceived social Influence -> Behavioural Intention	-0.010	0.158	0.874	Insignificant
H4	Perceived self-efficacy -> Behavioural Intention	0.004	0.069	0.945	Insignificant
H5	Perceived usefulness -> Behavioural Intention	0.435	3.418	0.001**	Significant

Note: ** $p < 0.01$, * $p < 0.05$, based on a two-tailed test; $t = 1.96$.

Multi-Group Analysis

A structural equation modelling-based multigroup analysis was conducted to examine the moderating effects of gender and marital status. The results indicated that all observed differences were statistically insignificant. Further exploration of path coefficient variances demonstrated that the impact of perceived ease of use and perceived usefulness on customers' behavioural intention towards SSTs in

banking was more pronounced among males compared to females. Additionally, the variations in path coefficients indicated that the influence of perceived ease of use, and perceived usefulness on customers' behavioural intention towards SSTs in banking was more robust among married individuals compared to unmarried ones. The summarised outcomes of the multi-group analysis are presented in Tables 5 and 6.

Table 5: Multi-Group Analysis Based on Gender

Relationships	Difference (Male - Female)	P Value	Results
Perceived ease of Use -> Behavioural Intention	0.361	0.151	Insignificant
Perceived usefulness -> Behavioural Intention	-0.042	0.877	Insignificant

Table 6: Multi-Group Analysis Based on Marital Status

Relationships	Difference (Married - Unmarried)	P Value	Results
Perceived ease of Use -> Behavioural Intention	0.151	0.517	Insignificant
Perceived usefulness -> Behavioural Intention	0.207	0.423	Insignificant

DISCUSSION

This study makes a valuable contribution to the existing body of literature on SSTs by empirically verifying the importance of various factors influencing the adoption of SSTs in the rural banking sector. Although various researchers have investigated the factors influencing the adoption of SSTs, a notable gap was identified in terms of research explicitly focusing on the rural banking sector. By addressing this research gap, the study offers critical insights into the significance and relevance of technology adoption factors in adopting SSTs among rural banking customers. The findings advance the understanding of SSTs and shed light on the unique nuances in the rural sector.

A conceptual model, grounded in existing literature, was formulated and subsequently validated with empirical data using PLS-SEM. Moreover, the study sought to explore the potential moderating impact of demographic characteristics, such as gender and marital status, on the connection between factors influencing the acceptance of online banking and customers' intent to use it. A conceptual model, incorporating these moderating variables, was developed, and hypotheses regarding the relationships among factors influencing SSTs acceptance and intention to use were formulated and tested. This research assessed the model's ability to predict customers' behavioural intention towards SSTs in banking by examining their explained variance (R-squared) (Chin, 2010). The model's R-squared is 54.5%. It means that these factors can explain 54.5% of the variance in customers' behavioural intention towards SSTs in banking. The R-squared value surpasses the recommended minimum of 40%, suggesting the model can adequately explain the endogenous constructs and possesses a moderate predictive capacity (Straub & Gefen, 2004).

The study's findings support a positive relationship between perceived usefulness and customers' behavioural intention towards SSTs in banking. This implies that individuals are more likely to adopt the SSTs if they perceive them

as offering benefits and utilities (Dwivedi et al., 2019; Venkatesh et al., 2012).

Furthermore, the study found a significant influence of perceived ease of use on customers' behavioural intention towards SSTs in banking, consistent with prior studies on the adoption of innovative technologies (Alalwan et al., 2016; Al-Somali et al., 2009a). As users engage in a cost-benefit analysis between the anticipated advantages and the effort required to utilise the technology, a system perceived as easy to use increases the likelihood of adoption use (Alalwan et al., 2018; Çelik, 2008). This is because, when the perceived benefits outweigh the effort involved, users are more likely to embrace the new technology. Interestingly, perceived risk, perceived social influence, and perceived self-efficacy, despite being recognised as influential factors in SST adoption, did not significantly influence SSTs intention in our study. These discrepancies may originate from the unique perspectives of rural populations in evaluating technologies. Concerning the moderating influence of demographics, the outcomes did not substantiate the moderating effect of gender and marital status on the association between factors influencing SSTs acceptance and the intention to use. However, variations in path coefficients unveiled that the influence of perceived ease of use and perceived usefulness on the intent to use SSTs was more prominent among males compared to females and married individuals compared to unmarried ones.

STUDY IMPLICATIONS

This research offers valuable insights for both academics and banking professionals. It can help them to explain, predict, and develop strategies to encourage wider adoption of SSTs in rural areas.

Implications for Theory

This study builds on the existing TAM by applying it to the specific context of rural Indian bank customers and their use

of SSTs. Previous research suggests that adding relevant factors from other models can improve TAM's explanatory power (Baabdullah et al., 2019; Khasawneh AI, 2015; Koksai, 2016). This study provides empirical evidence that including social influence, self-efficacy, and perceived risk strengthens TAM's ability to explain user behaviour towards SSTs in banking. Many studies have explored online and mobile banking adoption, but few have focused specifically on how rural Indian customers perceive and use a broader range of SSTs in banking. This research helps fill this gap in knowledge.

Implications to Practice

This study imparts valuable insights for service providers, affirming the multifaceted nature of factors influencing the acceptance of SSTs in banking, with certain factors deemed significant in the earlier studies seeming to have less influence in the context of the rural banking sector. These results are interesting in the sense that they question our basic assumptions regarding the factors influencing SST adoption in the banking sector, which are immune to geographical differences.

Notably, SSTs characterised by utility, thoughtful design, and user-friendliness garner wider acceptance among service consumers (Meuter et al., 2000; Yen, 2005).

The results highlight the importance of usefulness and ease of use as primary determinants of SST acceptance among rural banking customers. In this regard, banks may initiate targeted marketing communication campaigns for rural populations to highlight the usefulness of SSTs in terms of cost and time savings and overall convenience for customers. Further, ensuring necessary policies are developed and implemented to reduce the customers' cognitive load while interacting with the SSTs through a customer-centric interface. Given the technical and marketing communications aspects of this challenge, collaborative efforts among customer service, IT, product development, and marketing communications departments are essential.

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

Like any empirical research, our study faces several limitations. Firstly, we have ventured into a relatively novel research area concerning consumers' adoption of SSTs in rural banking areas, explaining approximately 54.5 percent of the variance in attitude toward SSTs through the constructs included in our study. Nonetheless, it is imperative to explore the other key factors contributing to

the remaining unexplained variance. Future research should delve into identifying and comprehending additional factors influencing consumers' attitudes and adoption of SSTs in rural banking areas.

Secondly, the predominant focus of many studies has been on understanding consumer behaviour toward specific SSTs, unravelling the reasons behind the adoption of a particular SST. While comprehending the factors influencing the choice of one SST over another is crucial, it becomes even more pivotal from a firm's perspective, given the varying implementation costs across SSTs. Given the varying costs of implementation across different SSTs, future research could undertake a comparative analysis to investigate why consumers opt for one SST over another. Understanding the key variables influencing these decisions can be valuable for firms.

Additionally, our findings and their implications were derived from a cross-sectional study. This methodology limitation reduces the capacity to capture temporal changes in the research constructs (Malaquias et al., 2018). A longitudinal study is imperative to elucidate the effects of temporal changes and provide a more nuanced understanding of consumer behaviour toward SSTs in banking.

CONCLUSION

This research investigates factors influencing customers' behavioural intention towards SSTs in banking in a developing country context, specifically India. It expands the TAM by incorporating perceived risk, perceived self-efficacy, and perceived social risk. Despite India boasting a large internet user base, SST adoption remains nascent in rural regions. By surveying 320 participants in the northern part of the country, the study proposes a conceptual model explaining 54.5% of the variance within the extended TAM framework. The findings reveal that perceived ease of use and perceived usefulness positively influence customers' intention to adopt SSTs. Additionally, the study did not find evidence of gender or marital status moderating the relationship between the investigated factors and the intention to use SSTs.

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DOES COVID-19 OUTBREAK AND RUSSIAN INVASION OF UKRAINE GENERATE ABNORMAL RETURNS?

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Abstract *The present study aims to examine the impact of two economic shocks i.e., COVID-19 and Ukraine-Russia war in the Indian equity market using 3 broad market indices and 14 sectoral indices of National Stock Exchange of India (NSE). Four events concerned with COVID-19 i.e., WHO announcement of COVID-19 as global pandemic, first lockdown in India, start of the second wave of COVID-19, peak of second wave and one event of Ukraine-Russia war have been selected for the analysis. In this study, daily stock returns have been used to compile abnormal returns and cumulative abnormal returns and event study methodology has been applied. It has been found that the selected indices show high volatility during various events, however, failed to generate abnormal returns.*

Keywords: COVID-19, Ukraine Russia War, Semi-Strong Form Market Efficiency and Event Study Methodology

JEL Classification: G1, F2, F3, F6

INTRODUCTION

Globalization has interconnected economies worldwide with heightening international financial interdependence along with offering numerous economic benefits. However, this interconnectedness has also posed significant challenges during crises (Liu et al., 2020), leading to rapid disruptions in one region affecting the global financial markets. For instance, the financial crises of 2008 resulted in the collapse of prominent United States financial institutions leading to substantial declines in global stock markets. This demonstrates the vulnerability of global financial systems to the disruptions originating from certain regions (Claessens, Kose & Terrones, 2010). These disruptions or crises result in heightened volatility in stock markets as the investors react to uncertainty and risks (Reinhart & Rogoff, 2009). Thus, it is required to study the repercussions of global crises on stock market (Varma et al., 2021) to avoid the undue impact.

In the past five years, the COVID-19 pandemic and Ukraine-Russia war are major global crises (Kumar et al., 2023) that have tested the resilience of economies, particularly emerging ones. Both crises have resulted in substantial financial difficulties for several economies worldwide. During these times, there has been a significant decline in

financial markets globally. There has been increase in stock market volatility, supply-chain disruptions and consumer behavior changes (Varma et al., 2021). Both the crises have occurred consecutively and affected the Indian stock market to greater extent. Therefore, in the present study, these two major crises have been considered.

The COVID-19 pandemic emerged in China in December, 2019 (Karim & Shetu, 2023; Varma et al., 2021). The pandemic was swiftly disseminated globally, resulting in major economic and health crises (Ningrum et al., 2020). It had a negative impact on nations both socially and psychologically, interrupting the daily lives with bringing considerable stress and anxiety (Saleh & Mujahiddin, 2020). The World Health Organization (WHO) declared it a global emergency on January 30, 2020 and classified it as a pandemic on March 13, 2020 (Varma et al., 2021). As a reaction, Governments worldwide implemented rigorous measures such as lockdowns, travel restrictions and social distancing (Au Yong & Laing, 2021; Umar et al., 2023), which had an additional impact on economic activities and worsen financial stability. Following the announcement of the lockdown on March 23, 2020, India also witnessed significant repercussions on its stock market (Varma et al., 2021). The Sensex of Bombay Stock Exchange (BSE) witnessed a fall on 13.2% on March 23, 2020. The Nifty of

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National Stock Exchange (NSE) declined by 29% in 2020 due to COVID-19 (Bora & Basistha, 2021), indicating the significant economic impact during the initial stage of the pandemic.

Furthermore, the second shock Ukraine Russia war, began on February 24, 2022 (Izzeldin et al., 2023) led to substantial causalities and triggered a refugee crisis in Europe (Sun et al., 2022). The war caused a sudden increase in crude oil prices, which had a negative influence on the financial stability of emerging economies. Initially, global stock markets responded negatively, affecting countries bordering two nations (Boungou & Yatié, 2022) and European Union (EU) countries. It also damaged several sectors such as finance sector, service sector, manufacturing sector and Oil & Gas companies in Russia (Sun et al., 2022). However, the effect weakened over time. Notably the Egyptian stock market's liquidity remained mostly unaffected (Gameel, 2022).

Given the above observations, the present study has tested the market efficiency during the crisis for which Efficient Market Hypothesis (EMH) the basis of market efficiency (Mishra et al., 2021), is selected for analysis purpose. The semi-strong form of EMH which claims that stock prices respond quickly to all historical and publicly available information and prevent investors from consistently securing abnormal profits (Fama, 1970) is most appropriate. The study has employed event study methodology, which is a commonly used methodology in finance (Rizvi et al., 2022). It is useful for understanding the stock market reactions (Mall & Gupta, 2019) by calculating Abnormal Returns (AR), Cumulative Abnormal Returns (CAR) and 't' statistics.

To the best of our knowledge, extensive study has been conducted on the individual consequences on how Indian equity market has reacted to COVID-19 and Ukraine Russia, there is a notable gap in the literature regarding their combined impact. The present study shall provide a comprehensive analysis of Nifty's three broad market indices and fourteen sectoral indices, aiming to fill the gaps in the literature by offering a thorough examination of Indian equity markets. The present research aims to investigate the following research questions and proposes to contribute to the existing literature:

RQ1: What is the impact of COVID-19 on the Indian equity market, particularly in relation to stock returns and sectoral performance?

RQ2: What is the impact of Ukraine Russia war on the Indian equity market?

The findings of the present study shall offer valuable insights into the impacts of economic shocks on stock market returns. It shall assist in strategic investment management

and facilitate future economic recovery. The financial analysts shall enhance their predictions and risk assessment by studying responses of various sectors that improves the accuracy of financial models and investment advice. The findings shall be useful for the investors for Governments to decide the optimum time to provide support to the underperforming sectors.

The subsequent sections of the study are organized as follows: Section 2 provides an overview of the existing literature, Section 3 explains the research methodology, while Section 4 presents the empirical results and discussions based on the analysis and its interpretation. Finally, Section 5 serves as the conclusion, including study's limitations and providing practical implications.

LITERATURE REVIEW

Impact of COVID-19 on Stock Market

The COVID-19 pandemic has shown a significant adverse effect on stock returns worldwide in both developed and emerging economies (Al-Awadhi et al., 2020; Harjoto, Rossi & Paglia, 2021; Kumar et al., 2021 and Uddin et al., 2021). The studies by Chaudhary et al. (2020), Liu et al. (2020) and Zaremba et al. (2020) have analyzed stock indices from the top 10, 21 and 67 countries, respectively. These studies have shown negative daily average returns across all the indices, with majorly affected countries experiencing decline in the stock markets. Asian countries have also witnessed significant adverse stock market returns.

Okorie and Lin (2021) have investigated the fractal contagion effect of pandemic on the stock markets of different countries and found evidence of fractal contagion. Nguyen et al. (2021) have noticed substantial contagion effect from the stock markets of United States and China throughout the pandemic, with some evidence of volatility spillover effects. Similarly, Yousfi et al. (2021) have observed contagion effects on financial markets, particularly in US. Baek, Mohanty and Glamboosky (2020) have found that the stock volatility was affected by both favorable (government interventions and medical advancements) and unfavorable news (infection rates and economic downturns) during COVID-19.

Mazur et al. (2021) have found that stocks in the hospitality, real estate, entertainment and petroleum sectors experienced greater declines to those in the natural gas, healthcare, food and software sectors in US market. In a similar study, Shankar and Dubey (2021) have observed negative effects in the banking sector, automobile sector, consumer durable sector, financial sector, realty sector and IT sector, while metals and

pharmaceutical sectors have been positively affected due to market panic and increased demand for medicines in Indian market.

Al-Awadhi et al. (2020) have examined Hang Seng Index and Shanghai Stock Exchange Composite Index of China, finding that increases in daily COVID-19 cases and fatalities led to decline in stock market returns. Moreover, Apergis and Apergis (2020) and Kumar et al. (2021) have studied the correlation between COVID-19 cases, fatalities and stock returns. The studies have observed adverse impact on stock market returns. These studies have demonstrated positive relationship of COVID-19 with stock market volatility and negative relationship with stock market returns. Ullah et al. (2023) have found that COVID-19 and economic policy uncertainty have significantly affected stock market returns in China, particularly during negative market conditions. He et al. (2020) have observed adverse short term effects on stock markets in countries such as France, Germany, China, Spain, Italy, South Korea, Japan and USA due to pandemic.

A few research studies have examined the impact of two waves of COVID-19 on various economies, where it has been found that first wave (April-June 2020) primarily affected developed countries, while the second wave (March-May 2021) has a significant impact on emerging countries. First wave has increased volatility in European stock markets and the second wave has impacted on Belgium's stock market (Dutillo et al., 2021).

Governments worldwide implemented rigorous measures such as lockdowns to mitigate the impact of COVID-19 and prevent its spread. According to the studies of Alam et al. (2020) and Hardi and Sihombing (2022), the response of stock markets before and after lockdown was different. Before lockdown, stock markets panicked, leading to selling of securities by investors and generating negative average abnormal returns. Baker et al. (2020) have found unprecedented volatility and Singh and Shaik (2021) have witnessed significant downturns in stock market during COVID-19. The reason is the investors lost their confidence leaving them nervous and anxious (Ahmed et al., 2021). Public authorities were advised to intervene during the adverse situation and support affected sectors (Jena & Mishra, 2022). However, after lockdown, positive Average Abnormal Returns (AAR) indicated that investors anticipated event (Alam et al., 2020) and their potential corrections (Phan & Narayan, 2020). Ahmed et al. (2021) have studied stock market performance during India's lockdown along with oil prices, which were initially affected, whereas, gold prices showed positive impact, however, these effects have been temporary, particularly during the second wave in South Asian countries. Liu et al. (2020) have studied the impact of lockdown announcements on stock returns and found negative abnormal returns in short run, which drastically

affected Asian stock markets because of widespread fear.

Bhattacharjee and De (2023) have studied relationship between COVID-19 policies and Indian equity market sentiments, observing temporary impacts and speculative activities. Sinha et al. (2021) have found negative impacts on emerging markets, including, stock returns, investor sentiments and macroeconomic variables. Bhama (2022) has studied COVID-19's impact on Nifty 100 in India, indicating a greater impact compared to other macroeconomic variables. The first wave of pandemic prepared businesses for subsequent pandemic waves, highlighting the importance of adaptive strategies.

Impact of Ukraine-Russia War on Stock Returns

Similarly, studies on Ukraine-Russia war have indicated its initial negative impact on global stock market returns and specific sectors. Federle et al. (2022) have analyzed stock markets in 66 nations, finding lower stock returns in the countries located within 1000 km radius of Ukraine. Bounou and Yatié (2022) have analysed the impact of Ukraine-Russia war on stock returns from 94 countries and found a correlation between the conflict and stock performance. Similarly, Boubaker et al. (2022) have employed event study methodology to investigate the effect and found that global stock market witnessed adverse cumulative abnormal returns. Additionally, Das et al. (2023) have found detrimental effect on stock returns in the industries reliant on suppliers from both countries. Furthermore, Yousaf et al. (2022) have reported negative impacts on Asian and European markets, while Deng et al. (2022) have found that the Ukraine-Russia war affected firm's ESG aspects, reporting inconsistent resilience indicators and geographical disparities due to Russian energy dependency.

The effects of COVID-19 and the Ukraine-Russia war on many economies and stock markets have been well documented. However, there is limited research on the Indian equity markets during both crises together. Additionally, most studies have examined certain sectors or companies rather than offering a broad market perspective by using multiple indices together. Therefore, further study is needed in Indian equity market, particularly sector performance and their empirical testing connected to COVID-19 and Ukraine-Russia war both in a single study.

RESEARCH METHODOLOGY

Based on the previously identified research gap, the objectives of the study have been formulated to examine the impact of two economic shocks on stock returns of the National Stock

Exchange (NSE) of India. To achieve the objectives, we have selected five events related to two economic shocks. Each event has been selected based on its relevance and potential

influence on the stock markets. The selected events along with their corresponding event dates and event windows are described in Table 1 below:

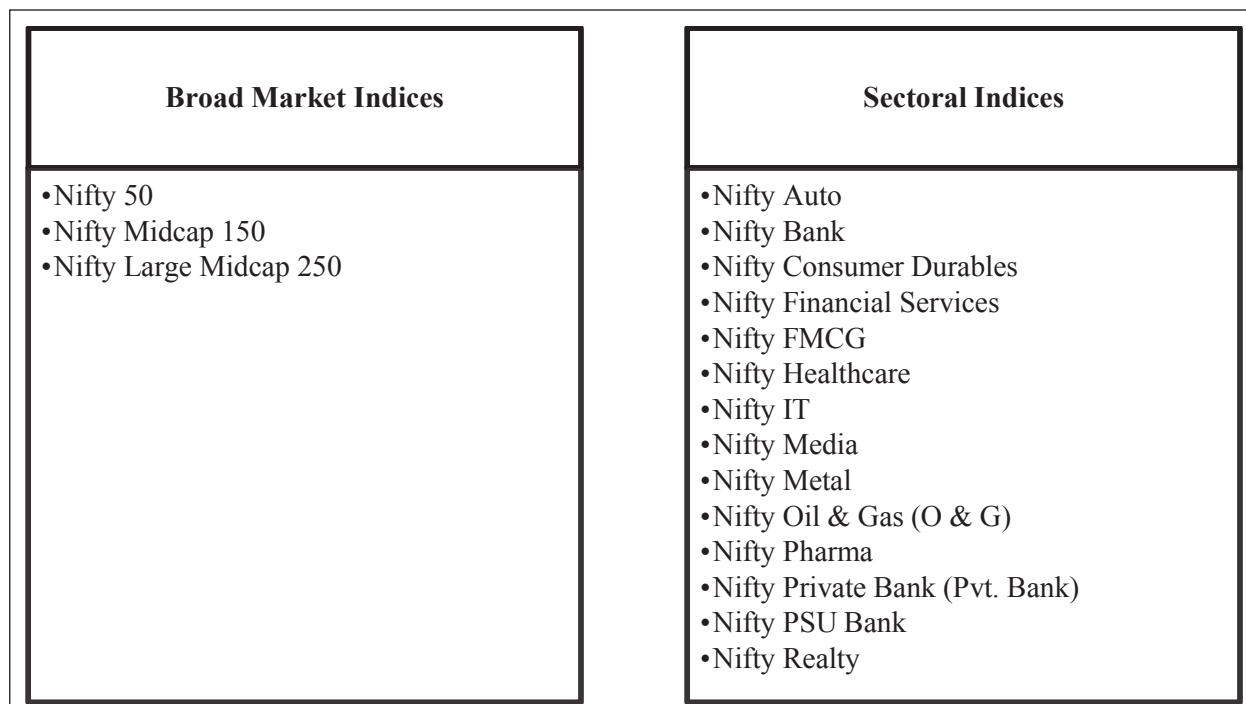
Table 1: Events, Event Dates and Event Window

Sr. No.	Event	Date	Window
1.	WHO Announcement of COVID-19 as global pandemic	11-03-2020	25-02-2020 to 25-03-2020
2.	First Lockdown in India due to COVID-19	25-03-2020	11-03-2020 to 13-04-2020
3.	Start of Second Wave of COVID-19	15-03-2021	26-02-2021 to 30-03-2021
4.	Peak of Second Wave of COVID-19	23-04-2021	07-04-2021 to 07-05-2021
5.	Ukraine-Russia War	24-02-2022	10-02-2022 to 11-03-2022

Source: Compiled by Author

For conducting the study, 3 broad market indices and 14 sectoral indices have been selected, list of which has been described in Fig. 1. The closing prices of the selected indices have been used to calculate abnormal returns during the

event window. NSE 500 has been taken as benchmark index. The study has used secondary data taken from the website of National Stock Exchange of India (www.nseindia.com).



Source: Compiled by author.

Fig. 1: List of Sample Nifty Indices

The study has employed event study methodology to examine the response of Indian equity market towards COVID-19 and Ukraine-Russia war. Event study examines the impact of certain event on securities returns during event window (Maitra & Dey, 2012). To check the impact

of selected events on stock market returns, 21 days event window has been selected where; t_0 is the day of event, $t-10$ is the 10 days before the event, and $t+10$ is the 10 days after the event.

Stock Return

The stock returns of Nifty indices for 21 days window is calculated using daily closing prices taken from NSE website. To calculate daily stock return of each Nifty Indices during observation window the following formula has been used:

$$R = \frac{P_t - P_{t-1}}{P_{t-1}} \quad (1)$$

Where:

R_t = Daily Stock return on t day

P_t = Stock closing price on t day

P_{t-1} = Stock closing price on t-1 day

Standard Returns

Nifty 500 is taken as benchmark index to calculate abnormal returns of stock indices. The data of closing prices of Nifty 500 has been taken for the observation window to calculate standard returns using following formula:

$$SR_t = \frac{(SP_t - SP_{t-1})}{SP_{t-1}} \quad (2)$$

Where:

SR_t = Daily Standard Return on t day

SP_t = Standard Closing Price on t day

SP_{t-1} = Standard Closing Price on t-1 day

Abnormal Returns (ARs)

To calculate ARs, stock returns and standard returns have been compared to get information about alpha generation using following formula:

$$AR_t = R_t - (b * SR_t) - a \quad (3)$$

AR_t = Abnormal return at time t

R_t = Actual return at time t,

b = slope of regression line

SR_t = Expected return at time t,

a = intercept

Cumulative Abnormal Returns (CARs)

From ARs, CARs have been calculated by using following formula:

$$CAR_{t;t+k} = \sum AR_{i,t+k} \quad (4)$$

Where:

$CAR_{t;t+k}$ = CARs for stock at time t

AR_t = Abnormal stock return at time t.

't' Statistics

't' statistics is used to test significance of hypothesis. If 't' statistics values are greater than critical values, results are considered to be significant. Following formula has been used:

$$t \text{ stats} = \frac{CAR_{it}}{SE} \quad (5)$$

't' stats = 't' statistic of CARs for stock at time t

it = CAR for each category,

SE = Standard Error

RESULTS ANALYSIS AND DISCUSSION

Using event study methodology, data pertaining to five events of economic shocks have been analyzed and presented in following sections:

WHO Announcement on COVID-19 as Pandemic

The announcement by WHO that COVID-19 was a pandemic has varied impact on different indices (Table 2). The significant ARs are observed in nifty auto on t+6 day, nifty bank on t+7 day, nifty consumer durable on t+6 day, nifty financial services on t+7 day, nifty FMCG on t+7 day, nifty IT on t+9 day, nifty metal on t-5 day, nifty midcap-150 on t+10 day, nifty oil and gas on t+7 day, nifty PSU banks on t+2 day, nifty private bank on t+7 day and nifty realty on t+9 day. Despite these significant ARs, the CARs have exhibited erratic patterns, ultimately balancing out to zero by the end of the observation window.

Table 2: AR and CAR of Nifty Indices for WHO Announcement of COVID-19 as Pandemic (25-02-2020 to 25-03-2020)

Period	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	
Nifty 50	AR	-0.0010	-0.0010	-0.0011	-0.0012	-0.0016	0.0008	-0.0029	-0.0017	-0.0009	0.0003	0.0029	0.0010	-0.0041	-0.0028	0.0005	0.0044	0.0015	0.0036	0.0023	0.0047	
	CAR	-0.0010	-0.0021	-0.0032	-0.0044	-0.0061	-0.0095	-0.0087	-0.0116	-0.0133	-0.0143	-0.0140	-0.0111	-0.0100	-0.0142	-0.0170	-0.0165	-0.0121	-0.0106	-0.0070	-0.0047	0.0000
Auto	AR	-0.0026	-0.0089	0.0029	-0.0018	0.0017	0.0066	0.0025	0.0026	0.0166	-0.0055	-0.0003	-0.0040	0.0140	0.0175	0.0050	-0.0309*	-0.0097	-0.0149	-0.0014	0.0012	
	CAR	-0.0026	-0.0115	-0.0086	-0.0104	-0.0087	-0.0021	-0.0005	0.0030	0.0197	0.0289	0.0234	0.0231	0.0191	0.0331	0.0506	0.0556	0.0247	0.0151	0.0002	-0.0012	0.0000
Bank	AR	0.0062	0.0109	0.0042	0.0098	0.0005	-0.0047	0.0269	-0.0049	0.0094	0.0057	0.0039	0.0146	0.0166	-0.0115	-0.0048	0.0123	-0.0452*	-0.0166	-0.0085	0.0182	
	CAR	0.0062	0.0046	0.0092	0.0096	0.0060	0.0004	0.0019	0.0095	0.0079	0.0098	0.0034	0.0036	0.0546	0.0562	0.0398	0.0521	0.0069	-0.0097	-0.0182	0.0000	
Consumer Durables	AR	0.0008	0.0054	0.0145	0.0241	0.0301	0.0305	0.0325	0.0420	0.0499	0.0563	0.0599	0.0514	0.0501	0.0565	0.0553	0.0365	0.0243	0.0102	-0.0042	0.0000	
	CAR	0.0035	0.0046	0.0015	0.0050	0.0034	-0.0107	-0.0066	-0.0009	-0.0014	0.0126	0.0043	0.0099	0.0167	0.0015	-0.0192	-0.0122	0.0132	-0.0334*	-0.0083	-0.0093	0.0259
Financial Services	AR	0.0035	0.0081	0.0096	0.0146	0.0179	0.0073	0.0006	-0.0003	0.0017	0.0109	0.0153	0.0251	0.0418	0.0433	0.0119	0.0251	-0.0084	-0.0166	-0.0259	0.0000	
	CAR	-0.0006	-0.0027	-0.0001	0.0023	-0.0051	-0.0079	-0.0047	0.0043	-0.0052	0.0036	-0.0022	-0.0081	-0.0263	-0.0049	0.0233	0.0103	0.0103	0.0356*	-0.0066	0.0123	-0.0274
FMCG	AR	-0.0006	-0.0033	-0.0034	-0.0011	-0.0062	-0.0141	-0.0188	-0.0145	-0.0197	-0.0162	-0.0184	-0.0265	-0.0527	-0.0577	-0.0344	-0.0241	-0.0138	0.0218	0.0151	0.0274	0.0000
	CAR	0.0065	-0.0068	-0.0114	-0.0251	0.0171	0.0011	0.0128	-0.0047	0.0067	-0.0092	-0.0131	-0.0116	-0.0231	-0.0163	-0.0092	0.0210	-0.0103	0.0377	0.0240	0.0396*	-0.0258
IT	AR	0.0065	-0.0003	-0.0116	-0.0367	-0.0196	-0.0185	-0.0057	-0.0104	-0.0037	-0.0130	-0.0377	-0.0276	-0.0294	-0.0608	-0.0862	-0.0652	-0.0755	-0.0378	-0.0138	0.0258	0.0000
	CAR	0.0083	0.0131	-0.0082	-0.0114	-0.0283	0.0336	0.0067	0.0103	-0.0085	-0.0266	0.0071	-0.0205	-0.0499	-0.0282	-0.0578	-0.0142	-0.0272	0.0154	-0.0062	0.0073	0.0000
Media	AR	0.0074	-0.0018	0.0000	-0.0269	-0.0116	0.0429*	0.0038	-0.0074	-0.0158	-0.0218	-0.0113	-0.0029	0.0258	-0.0138	0.0341	-0.0201	0.0244	0.0220	-0.0131	-0.0299	0.0000
	CAR	0.0074	0.0056	0.0056	-0.0213	-0.0329	0.0100	0.0138	0.0064	-0.0093	-0.0312	-0.0425	-0.0454	-0.0196	-0.0334	-0.0174	0.0167	-0.0034	0.0210	0.0430	0.0299	0.0000
Mid Cap 150	AR	0.0029	0.0021	0.0011	0.0063	0.0031	0.0073	-0.0048	0.0045	0.0055	0.0046	0.0001	-0.0024	0.0080	0.0004	-0.0006	-0.0100	0.0016	-0.0119	-0.0030	-0.0132*	
	CAR	0.0029	0.0049	0.0061	0.0124	0.0155	0.0229	0.0181	0.0226	0.0281	0.0327	0.0309	0.0310	0.0286	0.0366	0.0371	0.0365	0.0265	0.0280	0.0161	0.0132	0.0000
O&G	AR	-0.0115	-0.0080	-0.0080	0.0023	-0.0126	0.0100	-0.0001	-0.0137	-0.0033	-0.0174	-0.0093	0.0153	0.0120	0.0133	0.0230	-0.0193	0.0348*	0.0157	-0.0080	-0.0055	
	CAR	-0.0115	-0.0195	-0.0275	-0.0252	-0.0378	-0.0277	-0.0278	-0.0415	-0.0448	-0.0622	-0.0715	-0.0812	-0.0659	-0.0539	-0.0406	-0.0176	-0.0370	-0.0022	0.0135	0.0055	0.0000
Pharma	AR	-0.0231	-0.0086	0.0053	-0.0164	-0.0048	0.0355	0.0223	0.0017	-0.0020	-0.0015	-0.0315	0.0185	0.0055	0.0160	-0.0024	0.0101	0.0023	0.0163	0.0094	-0.0328	
	CAR	-0.0231	-0.0317	-0.0264	-0.0428	-0.0476	-0.0121	0.0103	0.0120	0.0101	0.0086	-0.0113	-0.0428	-0.0244	-0.0189	-0.0029	-0.0053	0.0049	0.0071	0.0234	0.0328	0.0000
PSU	AR	0.0080	0.0085	-0.0138	-0.0116	-0.0347	0.0020	0.0032	0.0162	-0.0240	-0.0094	-0.0473	0.0802*	0.0235	0.0219	0.0506	0.0043	-0.0281	0.0006	0.0073	-0.0325	
	CAR	0.0080	0.0165	0.0027	-0.0089	-0.0436	-0.0415	-0.0383	-0.0221	-0.0461	-0.0555	-0.0805	-0.1277	-0.0475	-0.0240	-0.0022	0.0484	0.0527	0.0246	0.0252	0.0325	0.0000
Private Banks	AR	0.0053	0.0106	0.0077	0.0149	0.0054	-0.0028	0.0061	0.0068	-0.0055	0.0088	0.0103	0.0119	0.0030	-0.0091	-0.0128	0.0129	-0.0448*	-0.0232	-0.0109	0.0172	
	CAR	0.0053	0.0159	0.0236	0.0384	0.0438	0.0410	0.0350	0.0418	0.0362	0.0450	0.0553	0.0672	0.0702	0.0708	0.0616	0.0489	0.0617	0.0169	-0.0063	-0.0172	0.0000
Realty	AR	0.0228	0.0027	-0.0098	0.0070	0.0126	0.0134	0.0056	-0.0028	0.0013	0.0141	-0.0064	-0.0175	0.0070	-0.0143	0.0060	-0.0062	0.0018	-0.0056	0.0043	-0.0256*	
	CAR	0.0228	0.0255	0.0157	0.0227	0.0353	0.0488	0.0544	0.0517	0.0530	0.0671	0.0607	0.0432	0.0502	0.0358	0.0418	0.0356	0.0374	0.0318	0.0361	0.0105	0.0000

Source: Based on Author's Calculations

Note: * shows significant values at 5% level of significance.

Lockdown Announcement due to COVID-19

Lockdown announcement has affected indices severely (Table 3). The nifty auto sector saw significant ARs on t+9 day, nifty bank on t-3 day, nifty consumer durable on t+9 day, nifty IT on t-3 and t-1 days, nifty midcap 150 on t+8 day, nifty oil and gas on t+4 day, nifty pharma on t+6 day, nifty PSU banks on t-8 day, nifty pvt. bank on t-3 day and nifty realty on t+1 day. Similar to the first event, the CARs have noticed to be inconsistent ultimately converged to zero by the end of the observation period.

Beginning of Second Wave of COVID-19

Beginning of second wave of COVID-19 has a significant impact on stock market indices (Table 4). The nifty auto is significant on t-8, t-7 day, nifty bank on t+5 day, nifty consumer durable on t+9 day, nifty financial services on t-3 day, nifty IT on t+3 day, nifty media on t-9 day, nifty metal on t-3 day, nifty midcap 150 on t-10 day, nifty PSU banks on t+6 day, nifty pvt. bank on t+5 day, nifty realty on t+5 day, and nifty large midcap 250 on t-10 day. The CAR have been showing mixed reactions. ARs gained have cumulated and resulted in zero at last.

Peak of Second Wave of COVID-19

Peak of second wave of COVID-19 event has affected indices severely (Table 5). Significant values for nifty 50 are showing on t+5 day, nifty auto has significant value on t-6 day, nifty consumer durable on t-9 and t-1 day, nifty FMCG on t+6 day, nifty IT on t-6 day, nifty media on t-2 day, nifty metal on t+3 and t+4 day, nifty midcap 150 on t+5 day, nifty pharma on t+8 day, nifty PSU banks on t+7 day, nifty realty on t+1 day, nifty healthcare on t+8 day and nifty large midcap t+5 and t+10 day. The CAR has erratic reactions, however, all ARs gained have cumulatively resulted in zero in end.

Ukraine-Russia War

Ukraine-Russia war event has affected indices severely (Table 6). The nifty 50 is significant on t+3 day, nifty consumer durable on t0 (event day) and t+5 day, nifty financial services on t0 and t+5 day, nifty FMCG on t+9 day, nifty media on t+3 day, nifty metal on t+3 day, nifty midcap 150 on t+1 day, nifty pharma on t+10 day, nifty pvt. bank on t0 and t+5 day, nifty realty on t-1 day, nifty healthcare on t+5 and t+10 day, nifty large midcap 250 on t0 and t+5 day and nifty oil and gas on t-3 day. The CARs have been showing zero or near to zero effects of event.

Table 3: AR and CAR of Nifty Indices for First Lockdown in India during COVID-19 (11-03-2020 to 13-04-2020)

Period	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Nifty 50	AR	0.0013	0.0044	0.0019	-0.0028	-0.0016	0.0056	0.0022	0.0053	0.0032	0.0054	-0.0047	-0.0003	-0.0062	-0.0017	-0.0053	-0.0022	0.0049	-0.0078	-0.0011	-0.0023
	CAR	0.0013	0.0057	0.0076	0.0048	0.0032	0.0105	0.0128	0.0181	0.0214	0.0267	0.0220	0.0217	0.0155	0.0138	0.0085	0.0063	0.0112	0.0034	0.0023	0.0000
Auto	AR	-0.0066	0.0059	-0.0082	0.0190	0.0183	0.0086	-0.0295	-0.0048	-0.0044	-0.0051	-0.0147	-0.0242	-0.0157	-0.0232	0.0205	-0.0097	0.0180	0.0182	0.0650*	-0.0118
	CAR	-0.0066	-0.0008	-0.0089	0.0100	0.0283	0.0369	0.0074	-0.0082	-0.0173	-0.0224	-0.0371	-0.0613	-0.0770	-0.1002	-0.0797	-0.0894	-0.0714	-0.0533	0.0118	0.0000
Bank	AR	0.0075	0.0116	0.0140	0.0084	-0.0081	0.0009	0.0161	-0.0472*	-0.0081	0.0160	0.0168	0.0211	-0.0103	-0.0210	-0.0030	-0.0256	0.0156	-0.0035	0.0078	-0.0033
	CAR	0.0075	0.0191	0.0331	0.0415	0.0334	0.0343	0.0504	0.0032	-0.0106	0.0054	0.0222	0.0433	0.0331	0.0121	0.0090	-0.0166	-0.0010	-0.0045	0.0033	0.0000
Consumer Durables	AR	-0.0032	0.0071	-0.0097	0.0017	0.0074	0.0011	-0.0175	-0.0087	-0.0152	0.0020	0.0170	0.0100	0.0026	-0.0063	0.0237	-0.0012	-0.0055	0.0002	0.0296*	-0.0207
	CAR	-0.0032	0.0039	-0.0059	-0.0042	0.0032	0.0043	-0.0132	-0.0361	-0.0513	-0.0493	-0.0323	-0.0223	-0.0198	-0.0261	-0.0024	-0.0036	-0.0091	-0.0088	0.0207	0.0000
Financial Service's	AR	0.0083	0.0168	0.0194	0.0079	-0.0145	-0.0063	0.0182	0.0003	-0.0061	0.0278	0.0082	0.0075	-0.0265	-0.0096	0.0041	-0.0169	-0.0068	-0.0025	0.0162	-0.0141
	CAR	0.0083	0.0251	0.0446	0.0525	0.0380	0.0317	0.0499	0.0185	0.0127	0.0405	0.0488	0.0562	0.0297	0.0201	0.0242	0.0073	0.0005	-0.0020	0.0141	0.0000
FMCG	AR	-0.0049	-0.0091	-0.0297	-0.0062	0.0210	0.0087	0.0081	0.0318	0.0091	-0.0313	0.0091	-0.0058	0.0266	0.0202	-0.0143	0.0149	0.0124	-0.0052	-0.0355	-0.0133
	CAR	-0.0049	-0.0141	-0.0437	-0.0500	-0.0289	-0.0203	-0.0121	0.0197	0.0221	-0.0092	-0.0001	-0.0059	0.0207	0.0409	0.0266	0.0415	0.0539	0.0488	0.0133	0.0000
IT	AR	-0.0094	-0.0114	-0.0179	-0.0155	-0.0065	0.0224	-0.0078	0.0437*	0.0222	-0.0197	-0.0112	0.0023	0.0141	0.0034	-0.0247	-0.0128	0.0083	-0.0085	-0.0160	0.0010
	CAR	-0.0094	-0.0209	-0.0388	-0.0543	-0.0608	-0.0384	-0.0462	-0.0025	0.0197	0.0639	0.0331	0.0353	0.0494	0.0528	0.0281	0.0152	0.0235	0.0150	-0.0010	0.0000
Media	AR	0.0293	-0.0327	-0.0336	0.0167	-0.0342	0.0387	-0.0176	0.0077	0.0093	-0.0114	-0.0108	-0.0044	0.0035	-0.0019	-0.0040	0.0077	0.0092	0.0246	0.0173	-0.0172
	CAR	0.0293	-0.0034	-0.0371	-0.0204	-0.0546	-0.0158	-0.0335	-0.0258	-0.0127	-0.0241	-0.0349	-0.0392	-0.0357	-0.0376	-0.0416	-0.0339	-0.0247	-0.0001	0.0172	0.0000
Metal	AR	-0.0152	-0.0139	0.0249	-0.0236	0.0102	0.0256	-0.0264	0.0251	0.0071	-0.0152	-0.0378	0.0061	0.0043	0.0162	0.0116	-0.0024	0.0005	-0.0094	0.0116	0.0296
	CAR	-0.0152	-0.0291	-0.0043	-0.0279	-0.0177	0.0078	-0.0186	0.0065	0.0136	-0.0304	-0.0682	-0.0621	-0.0577	-0.0415	-0.0299	-0.0323	-0.0318	-0.0412	-0.0296	0.0000
Mid Cap 150	AR	-0.0022	-0.0029	-0.0017	0.0054	-0.0007	-0.0027	-0.0113	0.0029	-0.0164	-0.0117	0.0061	-0.0012	0.0115	-0.0025	0.0146	0.0061	-0.0141	0.0189*	0.0024	0.0021
	CAR	-0.0022	-0.0051	-0.0068	-0.0014	-0.0020	-0.0047	-0.0161	-0.0131	-0.0295	-0.0439	-0.0378	-0.0390	-0.0275	-0.0300	-0.0155	-0.0094	-0.0234	-0.0046	-0.0021	0.0000
O&G	AR	-0.0140	-0.0182	0.0123	0.0041	0.0076	0.0158	-0.0253	0.0326	0.0050	-0.0075	-0.0292	-0.0182	0.0120	0.0401*	0.0040	0.0286	-0.0037	-0.0057	-0.0189	-0.0099
	CAR	-0.0140	-0.0322	-0.0199	-0.0158	-0.0082	0.0076	-0.0177	0.0150	0.0200	0.0009	-0.0283	-0.0465	-0.0346	0.0055	0.0096	0.0382	0.0345	0.0289	0.0099	0.0000
Pharma	AR	-0.0291	-0.0398	0.0089	-0.0029	0.0071	-0.0109	0.0013	-0.0075	0.0086	-0.0426	-0.0313	-0.0084	0.0264	0.0001	-0.0087	0.0484*	0.0328	0.0210	0.0037	0.0229
	CAR	-0.0291	-0.0688	-0.0599	-0.0628	-0.0557	-0.0666	-0.0653	-0.0728	-0.0643	-0.1069	-0.1382	-0.1466	-0.1202	-0.1201	-0.1288	-0.0804	-0.0476	-0.0266	-0.0229	0.0000
PSU	AR	-0.0231	-0.0558	0.0866*	0.0166	0.0210	0.0457	0.0026	-0.0193	0.0138	-0.0231	-0.0209	0.0089	0.0038	-0.0011	0.0030	-0.0177	-0.0332	0.0048	0.0068	-0.0037
	CAR	-0.0231	-0.0789	0.0077	0.0243	0.0453	0.0910	0.0936	0.0743	0.0605	0.0494	0.0285	0.0374	0.0412	0.0401	0.0432	0.0254	-0.0078	-0.0030	0.0037	0.0000
Pvt. Banks	AR	0.0116	0.0201	0.0013	0.0077	-0.0060	-0.0069	0.0165	-0.0481*	-0.0111	0.0135	0.0338	0.0205	-0.0094	-0.0333	-0.0005	-0.0264	0.0178	0.0017	0.0081	0.0007
	CAR	0.0116	0.0317	0.0330	0.0407	0.0347	0.0277	0.0442	-0.0039	-0.0150	-0.0129	0.0208	0.0413	0.0319	-0.0014	-0.0018	-0.0282	-0.0104	-0.0087	-0.0007	0.0000
Realty	AR	-0.0056	-0.0108	0.0053	-0.0086	0.0084	-0.0016	0.0046	-0.0086	0.0142	-0.0138	0.0359*	0.0061	-0.0284	0.0007	0.0225	0.0276	0.0050	-0.0039	0.0048	-0.0275
	CAR	-0.0056	-0.0164	-0.0111	-0.0197	-0.0113	-0.0129	-0.0083	-0.0169	-0.0290	-0.0429	-0.0069	-0.0009	-0.0292	-0.0286	-0.0061	0.0215	0.0266	0.0226	0.0275	0.0000

Source: Based on Author's Calculations

Note: * shows significant values at 5% level of significance.

Table 4: AR and CAR of Nifty Indices for Beginning of Second of COVID-19 (26-02-2021 to 30-03-2021)

Period	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Nifty 50	AR	-0.0045	-0.0004	-0.0024	0.0009	-0.0044	0.0033	-0.0004	0.0046	-0.0012	0.0005	-0.0014	0.0039	0.0016	0.0005	-0.0026	-0.0015	0.0012	0.0026	-0.0012	0.0022
	CAR	-0.0045	-0.0050	-0.0074	-0.0065	-0.0109	-0.0076	-0.0080	-0.0035	-0.0047	-0.0058	-0.0068	-0.0029	-0.0012	-0.0008	-0.0033	-0.0048	-0.0036	-0.0010	-0.0022	0.0000
Auto	AR	-0.0001	0.0116	0.0227*	0.0034	0.0038	-0.0008	-0.0062	0.0058	-0.0071	0.0038	0.0036	-0.0018	0.0119	-0.0043	0.0009	0.0009	-0.0068	0.0025	0.0025	-0.0066
	CAR	-0.0001	0.0116	0.0343	0.0115	0.0150	0.0188	0.0180	0.0176	0.0105	0.0143	0.0179	0.0162	0.0280	0.0237	0.0196	0.0205	0.0137	0.0041	0.0066	0.0000
Bank	AR	-0.0092	-0.0009	-0.0079	0.0067	-0.0059	0.0023	0.0141	-0.0020	-0.0006	0.0017	-0.0082	0.0042	0.0056	-0.0016	-0.0158*	0.0126	-0.0027	0.0136	-0.0029	-0.0034
	CAR	-0.0092	-0.0102	-0.0181	-0.0113	-0.0172	-0.0145	-0.0004	-0.0024	-0.0030	-0.0014	-0.0096	-0.0054	0.0002	-0.0014	-0.0173	-0.0046	-0.0073	0.0063	0.0034	0.0000
Consumer Durables	AR	0.0045	0.0005	0.0055	-0.0079	0.0059	-0.0027	-0.0030	0.0076	0.0060	0.0044	-0.0055	-0.0077	0.0029	-0.0044	-0.0069	-0.0027	-0.0005	-0.0061	0.0138*	-0.0011
	CAR	0.0045	0.0050	0.0105	0.0026	0.0085	0.0032	0.0002	0.0078	0.0138	0.0182	0.0127	0.0050	0.0079	0.0035	-0.0034	-0.0061	-0.0066	-0.0127	0.0011	0.0000
Financial services	AR	-0.0116	0.0016	-0.0110	0.0065	-0.0094	-0.0039	0.0186*	-0.0028	-0.0003	-0.0029	-0.0068	0.0080	0.0075	-0.0031	-0.0121	0.0032	0.0011	0.0130	0.0022	-0.0009
	CAR	-0.0116	-0.0100	-0.0210	-0.0145	-0.0239	-0.0246	-0.0060	-0.0087	-0.0090	-0.0120	-0.0188	-0.0108	-0.0033	-0.0065	-0.0185	-0.0153	-0.0142	-0.0012	0.0009	0.0000
FMCG	AR	0.0034	-0.0033	0.0019	-0.0113	0.0014	0.0036	-0.0090	-0.0055	-0.0015	0.0019	0.0060	0.0041	0.0069	0.0129	0.0128	-0.0114	-0.0036	-0.0130	0.0058	0.0050
	CAR	0.0034	0.0000	0.0020	-0.0094	-0.0080	-0.0044	-0.0134	-0.0189	-0.0204	-0.0254	-0.0195	-0.0154	-0.0085	0.0044	0.0172	0.0058	0.0022	-0.0108	-0.0050	0.0000
IT	AR	0.0054	-0.0083	0.0148	-0.0045	-0.0025	-0.0067	0.0000	0.0014	0.0076	0.0001	0.0093	0.0058	-0.0219*	-0.0074	0.0134	-0.0069	0.0034	-0.0079	-0.0105	0.0058
	CAR	0.0054	-0.0029	0.0119	0.0074	0.0049	-0.0017	-0.0018	-0.0003	0.0073	0.0074	0.0261	0.0320	0.0100	0.0026	0.0160	0.0091	0.0126	0.0047	-0.0058	0.0000
Media	AR	0.0042	0.0367	0.0369	0.0289	0.0531	0.0577	0.0694	0.0539	0.0548	0.0502	0.0522	0.0388	0.0519	0.0541	0.0454	0.0398	0.0335	0.0205	0.0126	0.0000
	CAR	0.0042	0.0367	0.0369	0.0289	0.0531	0.0577	0.0694	0.0539	0.0548	0.0502	0.0522	0.0388	0.0519	0.0541	0.0454	0.0398	0.0335	0.0205	0.0126	0.0000
Metal	AR	0.0087	-0.0004	-0.0082	0.0084	-0.0143	-0.0141	0.0048	-0.0321*	0.0102	-0.0007	0.0170	-0.0100	-0.0074	0.0133	0.0056	0.0054	-0.0156	0.0190	0.0199	0.0029
	CAR	0.0087	0.0083	0.0001	0.0085	-0.0058	-0.0200	-0.0151	-0.0472	-0.0370	-0.0377	-0.0307	-0.0381	-0.0248	-0.0192	-0.0137	-0.0294	-0.0417	-0.0228	-0.0029	0.0000
Mid Cap 150	AR	0.0136*	0.0012	0.0044	-0.0018	0.0093	-0.0100	0.0016	-0.0085	0.0017	-0.0032	-0.0018	0.0021	-0.0096	-0.0045	0.0056	0.0007	-0.0035	-0.0043	0.0033	-0.0005
	CAR	0.0136	0.0148	0.0192	0.0174	0.0268	0.0168	0.0183	0.0099	0.0116	0.0148	0.0150	0.0054	0.0009	-0.0013	0.0043	0.0050	0.0015	-0.0028	0.0005	0.0000
Pharma	AR	0.0063	0.0006	0.0030	-0.0066	0.0017	-0.0042	0.0018	-0.0132	0.0092	-0.0051	-0.0086	-0.0019	-0.0072	-0.0145	0.0032	-0.0012	0.0142	0.0043	-0.0056	0.0106
	CAR	0.0063	0.0070	0.0099	0.0033	0.0050	0.0008	0.0026	-0.0106	-0.0014	-0.0065	-0.0170	-0.0242	-0.0387	-0.0355	-0.0222	-0.0234	-0.0092	-0.0049	-0.0106	0.0000
PSU	AR	0.0052	-0.0162	-0.0104	0.0136	0.0065	-0.0180	0.0205	-0.0090	-0.0024	-0.0009	0.0164	-0.0069	0.0016	0.0068	-0.0068	0.0276*	-0.0044	0.0016	-0.0017	-0.0110
	CAR	0.0052	-0.0111	-0.0215	-0.0079	-0.0014	-0.0195	0.0011	-0.0079	-0.0103	-0.0112	0.0052	-0.0018	-0.0137	-0.0121	-0.0054	-0.0121	0.0155	0.0111	0.0126	0.0110
Pvt. Banks	AR	-0.0092	-0.0012	-0.0058	0.0078	-0.0034	0.0002	-0.0001	0.0151	-0.0010	0.0001	-0.0006	0.0074	0.0047	0.0043	-0.0014	-0.0166*	0.0127	-0.0028	0.0138	-0.0055
	CAR	-0.0092	-0.0104	-0.0162	-0.0084	-0.0117	-0.0115	-0.0116	0.0035	0.0025	0.0026	-0.0054	-0.0007	0.0036	0.0022	-0.0144	-0.0117	-0.0045	0.0093	0.0055	0.0000
Realty	AR	0.0109	0.0036	0.0004	0.0017	0.0094	-0.0010	-0.0086	-0.0116	0.0044	0.0015	-0.0025	-0.0133	-0.0015	-0.0118	0.0286*	0.0084	-0.0112	-0.0077	0.0091	-0.0137
	CAR	0.0109	0.0144	0.0148	0.0165	0.0259	0.0249	0.0163	0.0048	0.0092	0.0107	0.0130	-0.0003	-0.0018	-0.0136	0.0150	0.0234	0.0122	0.0046	0.0137	0.0000
Health-care	AR	0.0076	0.0022	0.0013	-0.0073	0.0025	-0.0065	0.0020	-0.0103	0.0055	-0.0017	0.0019	-0.0088	-0.0118	0.0006	0.0100	0.0009	0.0105	0.0014	-0.0043	0.0094
	CAR	0.0076	0.0098	0.0111	0.0038	0.0063	-0.0001	0.0019	-0.0085	-0.0029	-0.0047	-0.0099	-0.0167	-0.0285	-0.0279	-0.0179	-0.0170	-0.0065	-0.0051	-0.0094	0.0000
Large Mid Cap 250	AR	0.0053*	0.0002	0.0018	-0.0005	0.0035	-0.0040	0.0004	-0.0030	0.0005	0.0009	0.0008	-0.0035	-0.0017	-0.0008	0.0023	0.0002	-0.0013	-0.0013	0.0013	-0.0001
	CAR	0.0053	0.0055	0.0073	0.0068	0.0102	0.0062	0.0066	0.0036	0.0041	0.0050	0.0043	0.0015	-0.0002	-0.0002	0.0014	0.0016	0.0003	-0.0012	0.0001	0.0000

Source: Based on Author's Calculations

Note: * shows significant values at 5% level of significance.

Table 5: AR and CAR of Nifty Indices for Second Wave Peak of COVID-19 (07-04-2021 to 07-05-2021)

Period	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Nifty 50	AR	-0.0001	-0.0007	-0.0012	0.0039	0.0008	-0.0020	0.0001	-0.0024	0.0018	-0.0021	0.0014	0.0004	0.0026	0.0012	-0.0044*	-0.0019	-0.0017	-0.0002	0.0007	0.0022
	CAR	-0.0001	-0.0008	-0.0020	0.0019	0.0027	0.0022	0.0023	-0.0001	0.0017	-0.0003	0.0011	0.0014	0.0040	0.0052	0.0008	-0.0011	-0.0028	-0.0029	-0.0022	0.0000
Auto	AR	0.0036	-0.0033	-0.0014	0.0025	0.0258*	0.0064	-0.0038	0.0134	-0.0061	-0.0013	-0.0067	-0.0080	0.0011	-0.0107	0.0048	-0.0002	0.0020	-0.0044	0.0092	-0.0052
	CAR	0.0036	0.0003	-0.0011	0.0013	0.0271	0.0159	0.0121	0.0255	0.0194	0.0181	0.0114	0.0034	0.0045	-0.0062	-0.0013	-0.0016	0.0004	-0.0040	0.0052	0.0000
Bank	AR	0.0012	-0.0128	-0.0081	0.0072	0.0128	-0.0109	0.0023	-0.0001	0.0129	0.0017	0.0047	-0.0024	0.0126	-0.0015	-0.0079	-0.0128	0.0054	0.0032	-0.0085	-0.0042
	CAR	0.0012	-0.0116	-0.0197	-0.0125	0.0003	-0.0054	-0.0031	-0.0032	0.0097	0.0114	0.0161	0.0137	0.0262	0.0247	0.0168	0.0041	0.0095	0.0127	0.0042	0.0000
Consumer Durables	AR	-0.0017	0.0166*	0.0065	-0.0065	-0.0049	0.0052	0.0048	0.0066	-0.0167*	0.0002	0.0032	0.0081	-0.0016	-0.0054	0.0079	-0.0145	-0.0005	0.0016	-0.0007	-0.0074
	CAR	-0.0017	0.0149	0.0214	0.0149	0.0100	0.0144	0.0193	0.0259	0.0092	0.0094	0.0125	0.0206	0.0190	0.0136	0.0215	0.0070	0.0065	0.0081	0.0074	0.0000
Financial services	AR	-0.0019	-0.0101	-0.0058	0.0093	0.0152	-0.0085	0.0013	-0.0034	0.0124	0.0028	-0.0127	0.0066	0.0116	-0.0013	-0.0121	-0.0055	0.0021	-0.0026	-0.0037	0.0006
	CAR	-0.0019	-0.0120	-0.0179	-0.0086	0.0066	0.0040	0.0053	0.0019	0.0143	0.0171	0.0044	0.0110	0.0225	0.0212	0.0091	0.0035	0.0056	0.0031	-0.0006	0.0000
FMCG	AR	0.0024	0.0030	0.0094	0.0011	-0.0009	0.0043	0.0003	-0.0045	-0.0094	-0.0072	0.0007	-0.0005	-0.0016	-0.0030	-0.0037	0.0109*	-0.0002	-0.0012	0.0020	0.0009
	CAR	0.0024	0.0054	0.0147	0.0159	0.0149	0.0165	0.0168	0.0123	0.0028	-0.0043	-0.0036	-0.0041	-0.0057	-0.0087	-0.0124	-0.0015	-0.0017	-0.0029	-0.0009	0.0000
IT	AR	0.0076	0.0104	0.0094	-0.0045	-0.0381*	0.0106	0.0055	-0.0121	-0.0040	-0.0067	-0.0006	0.0007	0.0008	-0.0031	-0.0013	0.0001	-0.0031	0.0084	0.0159	-0.0010
	CAR	0.0076	0.0180	0.0274	0.0229	-0.0152	0.0005	0.0060	-0.0061	-0.0101	-0.0168	-0.0174	-0.0167	-0.0159	-0.0190	-0.0203	-0.0202	-0.0232	-0.0149	0.0010	0.0000
Media	AR	-0.0075	-0.0040	0.0097	-0.0205	-0.0023	0.0110	0.0007	0.0330*	0.0086	0.0078	-0.0125	-0.0012	-0.0087	-0.0048	0.0165	-0.0174	0.0104	-0.0097	0.0025	0.0015
	CAR	-0.0075	-0.0115	-0.0018	-0.0223	-0.0246	-0.0377	-0.0260	0.0069	0.0156	0.0234	0.0109	0.0097	0.0010	-0.0038	0.0127	-0.0047	0.0057	-0.0040	-0.0015	0.0000
Metal	AR	-0.0153	0.0225	-0.0139	-0.0105	0.0043	-0.0020	0.0020	-0.0027	-0.0015	-0.0094	-0.0030	-0.0001	-0.0312*	0.0340*	0.0090	0.0084	-0.0043	-0.0132	0.0050	0.0305
	CAR	-0.0153	0.0072	-0.0067	-0.0172	-0.0130	-0.0235	-0.0215	-0.0242	-0.0256	-0.0350	-0.0381	-0.0381	-0.0693	-0.0353	-0.0263	-0.0180	-0.0223	-0.0355	-0.0305	0.0000
Mid Cap	AR	0.0011	0.0006	0.0026	-0.0081	-0.0006	0.0048	0.0002	0.0040	-0.0031	0.0055	-0.0023	0.0013	-0.0033	-0.0037	0.0102*	0.0012	0.0051	-0.0017	-0.0009	-0.0088
	CAR	0.0011	0.0017	0.0043	-0.0038	-0.0044	-0.0040	-0.0037	0.0002	-0.0028	0.0027	0.0004	0.0017	-0.0015	-0.0052	0.0050	0.0062	0.0113	0.0096	0.0088	0.0000
Pharma	AR	0.0001	-0.0052	0.0262	-0.0033	-0.0175	0.0093	0.0142	0.0087	-0.0085	-0.0086	-0.0139	0.0016	-0.0088	-0.0010	0.0097	-0.0018	-0.0239	0.0360*	-0.0073	-0.0049
	CAR	0.0001	-0.0050	0.0211	0.0178	0.0003	0.0096	0.0238	0.0314	0.0229	0.0143	0.0004	0.0020	-0.0068	-0.0078	0.0018	0.0001	-0.0238	0.0122	0.0049	0.0000
PSU	AR	0.0021	-0.0162	0.0244	-0.0158	0.0209	-0.0194	-0.0138	0.0025	-0.0031	0.0085	0.0018	0.0019	0.0035	-0.0123	0.0162	-0.0093	0.0501*	-0.0011	-0.0238	-0.0093
	CAR	0.0021	-0.0141	0.0104	-0.0054	0.0155	-0.0040	-0.0178	-0.0232	-0.0263	-0.0178	-0.0160	-0.0141	-0.0106	-0.0229	-0.0066	-0.0160	0.0341	0.0330	0.0093	0.0000
Pvt.	AR	0.0015	-0.0127	-0.0069	0.0065	0.0135	0.0028	-0.0100	0.0009	0.0033	-0.0127	0.0153	0.0119	0.0123	0.0007	-0.0035	-0.0141	0.0052	0.0029	-0.0104	-0.0051
	CAR	0.0015	-0.0112	-0.0181	-0.0117	0.0019	-0.0054	-0.0079	-0.0035	0.0059	0.0092	-0.0035	0.0119	0.0242	0.0249	0.0214	0.0074	0.0126	0.0155	0.0051	0.0000
Realty	AR	-0.0017	0.0048	-0.0002	-0.0085	0.0109	-0.0079	-0.0086	0.0100	0.0072	-0.0034	0.0239*	-0.0071	-0.0212	0.0015	0.0167	-0.0060	0.0115	-0.0200	0.0001	0.0041
	CAR	-0.0017	0.0031	0.0029	-0.0056	0.0053	-0.0088	-0.0174	-0.0073	-0.0001	-0.0035	0.0204	0.0132	-0.0080	-0.0064	0.0103	0.0042	0.0157	-0.0043	-0.0041	0.0000
Health-care	AR	0.0042	-0.0023	0.0205	-0.0034	-0.0155	0.0059	0.0133	0.0009	-0.0097	-0.0079	-0.0129	0.0010	-0.0084	-0.0016	0.0067	0.0020	-0.0195	0.0298*	-0.0080	-0.0031
	CAR	0.0042	0.0019	0.0224	0.0190	0.0035	0.0094	0.0226	0.0317	0.0220	0.0141	0.0012	0.0021	-0.0062	-0.0079	-0.0011	0.0009	-0.0187	0.0111	0.0031	0.0000
Large Mid Cap	AR	0.0004	0.0001	0.0009	-0.0030	-0.0002	-0.0014	0.0019	0.0002	0.0013	0.0021	-0.0009	0.0005	-0.0010	-0.0015	0.0038*	0.0002	0.0021	-0.0005	-0.0003	0.0000
	CAR	0.0004	0.0006	0.0015	-0.0015	-0.0018	-0.0032	-0.0012	0.0003	-0.0009	0.0012	0.0003	0.0008	-0.0002	-0.0017	0.0021	0.0022	0.0043	0.0039	0.0036	0.0000

Source: Based on Author's Calculations

Note: * shows significant values at 5% level of significance.

Table 6: AR and CAR of Nifty Indices for Ukraine-Russia War (10-02-2022 to 11-03-2022)

Period	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Nifty 50	AR	0.0020	0.0007	0.0008	0.0033	-0.0008	0.0022	0.0033	0.0003	-0.0030	0.0002	-0.0034	-0.0001	-0.0041*	-0.0023	0.0010	-0.0010	-0.0006	0.0016	0.0009	-0.0012
	CAR	0.0020	0.0027	0.0035	0.0068	0.0060	0.0082	0.0115	0.0118	0.0089	0.0091	0.0058	0.0057	0.0016	-0.0007	0.0003	-0.0007	-0.0013	0.0003	0.0012	0.0000
Auto	AR	-0.0041	0.0119	0.0063	0.0097	0.0019	0.0043	0.0031	0.0086	0.0117	0.0006	-0.0057	-0.0131	-0.0160	-0.0130	-0.0101	-0.0086	-0.0003	0.0082	0.0048	-0.0039
	CAR	-0.0041	0.0078	0.0140	0.0237	0.0256	0.0299	0.0329	0.0416	0.0533	0.0539	0.0520	0.0389	0.0229	0.0099	-0.0002	-0.0089	-0.0092	-0.0009	0.0039	0.0000
Bank	AR	0.0051	0.0068	-0.0008	0.0034	-0.0022	-0.0075	0.0089	0.0136	0.0026	0.0013	0.0036	0.0013	-0.0139	-0.0046	0.0071	-0.0146	-0.0014	-0.0013	0.0042	0.0003
	CAR	0.0051	0.0119	0.0111	0.0145	0.0123	0.0048	0.0137	0.0273	0.0300	0.0349	0.0362	0.0222	0.0104	0.0058	0.0128	-0.0018	-0.0031	-0.0045	-0.0003	0.0000
Consumer Durables	AR	-0.0017	-0.0133	-0.0070	0.0151	0.0096	0.0003	0.0003	-0.0045	0.0015	0.0279*	-0.0151	-0.0037	0.0049	0.0033	-0.0350*	-0.0084	-0.0037	0.0044	0.0152	0.0007
	CAR	-0.0017	-0.0151	-0.0221	-0.0070	0.0026	0.0029	0.0032	-0.0013	0.0002	0.0094	0.0222	0.0186	0.0235	0.0268	-0.0082	-0.0166	-0.0203	-0.0159	-0.0007	0.0000
Financial Services	AR	0.0096	-0.0011	-0.0146	0.0126	0.0012	0.0084	0.0087	0.0044	-0.0002	0.0402*	-0.0195	-0.0036	0.0083	0.0061	-0.0619*	-0.0225	0.0038	0.0083	0.0098	0.0021
	CAR	0.0096	0.0085	-0.0061	0.0065	0.0077	0.0076	0.0160	0.0248	0.0291	0.0290	0.0497	0.0460	0.0544	0.0604	-0.0015	-0.0240	-0.0202	-0.0119	-0.0021	0.0000
FMCG	AR	-0.0018	0.0027	-0.0022	-0.0005	0.0011	0.0037	0.0009	-0.0025	-0.0034	0.0002	-0.0076	-0.0007	0.0013	-0.0066	0.0019	-0.0099	0.0018	-0.0018	0.0182*	0.0006
	CAR	-0.0018	0.0009	-0.0013	-0.0018	-0.0007	0.0030	0.0039	0.0014	-0.0020	-0.0018	-0.0038	-0.0044	-0.0031	-0.0097	-0.0078	-0.0177	-0.0158	-0.0176	0.0006	0.0000
IT	AR	0.0029	-0.0184	0.0085	0.0063	-0.0048	-0.0064	-0.0036	0.0032	-0.0067	-0.0039	0.0030	0.0021	-0.0004	0.0132	0.0122	0.0146	0.0164	-0.0068	-0.0152	-0.0065
	CAR	0.0029	-0.0156	-0.0071	-0.0008	-0.0056	-0.0120	-0.0156	-0.0124	-0.0191	-0.0230	-0.0294	-0.0274	-0.0278	-0.0146	-0.0024	0.0121	0.0285	0.0217	0.0065	0.0000
Media	AR	0.0064	0.0041	-0.0001	-0.0013	-0.0063	-0.0076	-0.0031	-0.0185	-0.0249	-0.0042	0.0055	-0.0062	0.0270*	0.0082	-0.0076	0.0251	0.0119	0.0124	-0.0184	-0.0065
	CAR	0.0064	0.0106	0.0105	0.0091	0.0028	-0.0047	-0.0078	-0.0263	-0.0512	-0.0472	-0.0459	-0.0521	-0.0169	-0.0169	-0.0245	0.0006	0.0125	0.0249	0.0065	0.0000
Metal	AR	0.0016	0.0046	-0.0215	-0.0108	-0.0090	-0.0064	-0.0028	-0.0172	-0.0080	-0.0033	0.0227	0.0365	0.0440*	0.0122	-0.0192	0.0406	-0.0298	-0.0280	0.0032	-0.0033
	CAR	0.0016	0.0061	-0.0154	-0.0262	-0.0352	-0.0416	-0.0444	-0.0616	-0.0696	-0.0729	-0.0788	-0.0561	-0.0196	0.0243	0.0365	0.0579	0.0281	0.0001	0.0033	0.0000
Mid Cap 150	AR	-0.0039	-0.0031	-0.0022	-0.0038	0.0002	-0.0008	-0.0034	-0.0025	-0.0008	0.0031	0.0074*	0.0001	0.0064	0.0029	-0.0014	0.0041	0.0000	-0.0004	-0.0050	0.0024
	CAR	-0.0039	-0.0070	-0.0093	-0.0131	-0.0129	-0.0137	-0.0171	-0.0196	-0.0204	-0.0173	-0.0165	-0.0091	-0.0091	0.0002	-0.0011	0.0030	0.0030	0.0026	-0.0024	0.0000
O&G	AR	0.0024	0.0020	-0.0161	0.0100	0.0045	0.0074	-0.0102	-0.0180*	-0.0074	-0.0014	0.0119	-0.0077	-0.0025	0.0014	0.0007	0.0103	0.0041	-0.0100	0.0053	0.0062
	CAR	0.0024	0.0044	-0.0117	-0.0017	0.0028	0.0102	0.0000	-0.0180	-0.0254	-0.0268	-0.0150	-0.0226	-0.0251	-0.0237	-0.0230	-0.0127	-0.0086	-0.0186	-0.0133	0.0000
Pharma	AR	-0.0023	0.0012	0.0021	-0.0123	0.0047	-0.0078	-0.0070	-0.0094	-0.0019	-0.0003	0.0036	-0.0047	-0.0144	-0.0017	0.0071	0.0107	0.0155	0.0021	-0.0099	0.0212*
	CAR	-0.0023	-0.0010	0.0011	-0.0112	-0.0065	-0.0143	-0.0213	-0.0307	-0.0326	-0.0328	-0.0259	-0.0306	-0.0450	-0.0467	-0.0396	-0.0289	-0.0134	-0.0113	-0.0212	0.0000
PSU	AR	-0.0084	0.0047	-0.0060	-0.0019	-0.0081	-0.0080	0.0068	0.0003	-0.0012	0.0105	-0.0020	0.0024	-0.0099	0.0032	0.0020	-0.0068	0.0113	-0.0098	0.0020	0.0060
	CAR	-0.0084	-0.0037	-0.0097	-0.0117	-0.0197	-0.0278	-0.0209	-0.0206	-0.0218	-0.0113	-0.0133	-0.0109	-0.0209	-0.0177	-0.0157	-0.0027	-0.0096	0.0018	-0.0080	0.0000
Pvt. Banks	AR	0.0082	0.0040	-0.0124	0.0144	-0.0003	-0.0078	0.0068	0.0114	0.0021	0.0042	0.0410*	-0.0194	-0.0033	0.0088	0.0065	-0.0623*	-0.0268	0.0078	0.0098	0.0010
	CAR	0.0082	0.0122	-0.0002	0.0142	0.0139	0.0060	0.0129	0.0243	0.0264	0.0306	0.0716	0.0522	0.0489	0.0576	0.0641	0.0018	-0.0251	-0.0186	-0.0108	0.0000
Realty	AR	-0.0015	0.0030	-0.0009	-0.0147	0.0126	-0.0008	-0.0063	-0.0017	-0.0177	0.0292*	0.0081	0.0056	-0.0077	-0.0001	0.0016	-0.0023	-0.0175	0.0155	-0.0015	-0.0011
	CAR	-0.0015	0.0015	0.0006	-0.0140	-0.0014	-0.0022	-0.0085	-0.0102	-0.0279	0.0013	0.0094	0.0150	0.0072	0.0071	0.0087	0.0064	-0.0111	0.0044	0.0029	0.0011
Health care	AR	0.0011	-0.0057	-0.0094	0.0015	0.0027	-0.0069	-0.0067	-0.0122	0.0003	0.0004	0.0176	-0.0113	-0.0036	0.0022	0.0011	-0.0222*	0.0029	0.0200	0.0078	0.0242*
	CAR	0.0011	-0.0046	-0.0140	-0.0125	-0.0098	-0.0167	-0.0235	-0.0356	-0.0353	-0.0350	-0.0174	-0.0287	-0.0323	-0.0301	-0.0290	-0.0512	-0.0483	-0.0283	-0.0242	0.0000
Large Mid Cap 250	AR	0.0027	-0.0067	-0.0145	0.0130	0.0003	0.0005	-0.0020	-0.0026	0.0021	0.0024	0.0299*	-0.0034	0.0057	0.0039	-0.0290*	-0.0082	0.0059	0.0101	0.0061	0.0034
	CAR	0.0027	-0.0039	-0.0185	-0.0055	-0.0052	-0.0047	-0.0066	-0.0092	-0.0113	-0.0088	0.0211	0.0056	0.0021	0.0117	-0.0172	-0.0254	-0.0196	-0.0095	-0.0034	0.0000

Source: Based on Author's Calculations.

Note: * shows significant values at 5 % level of significance.

From above findings, it can be observed that there has been short-term volatility across different indices. Events like WHO announcement of COVID-19 as pandemic and the Ukraine-Russia war caused immediate, however, brief abnormal returns in various indices. The Indian stock market returns during pre-lockdown phase have showed detrimental effects linked to panic, fear and uncertainty and the findings are consistent with Jena and Mishra (2022) and Liu et al. (2020). However, lockdown period has exhibited positive AR in some sectors, indicating that investors anticipated event and expected improvements and the findings are consistent with the study of Alam, Alam and Chavali (2020). The sectors such as auto, banking (both PSU and private), consumer durables, IT, midcap-150, metal, pharmaceuticals, financial services and real estate demonstrate short-term volatility to the economic shocks. Health and Pharmaceuticals sectors have failed to generate consistent ARs contrasting with the finding of Alam et al. (2020). Furthermore, Ukraine-Russia war has correlated negatively with stock market returns consistent with the findings of Boungou and Yatié (2022). Despite these ARs, the CARs for all events balanced out to zero, indicating that the market efficiency processed from the new information and only one or two days in observation window, showing significant ARs, however, no index consistently has generated ARs as the assumptions of EMH in five events. Both selected economic shocks have showed short lived impacts on selected stock market indices.

CONCLUSION

The present study has examined COVID-19 and Ukraine-Russia war's impact on Indian equity market. It has analyzed 3 board market indices and 14 sectoral indices of NSE using an event study methodology for the five events i.e. WHO Announcement of COVID-19 as global pandemic, First Lockdown in India due to COVID-19, Start of Second Wave of COVID-19, Peak of Second Wave of COVID-19 and Ukraine-Russia War. Daily stock prices of selected indices have been used for determining AR, CAR, and 't' statistics. As per the findings, high volatility in stock market returns have been observed. However, the indices have failed to generate consistent ARs. The events reflected share prices across all indices, however, overall stock returns have minimally affected with CARs overall zero by observations period's end, aligned with results of Hardi and Sihombing (2022).

The study has encountered limitations, suggesting that future research should include more Nifty indices and individual sectors. The researchers might include estimation window and macro-economic variables to enhance comprehensiveness of the analysis.

PRACTICAL IMPLICATIONS

The findings of the study suggest to the investors that although there may be significant short-term fluctuations in profits or losses during economic crises, it is important to maintain a long term perspective that helps in reducing panic-driven decisions as the markets adjust and stabilize quickly. The financial analysts can enhance their predictions and risk assessment by studying responses of various sectors that improves the accuracy of financial models and investment advice. Nonetheless, understanding market behavior assist Government and regulatory bodies in taking corrective actions to mitigate adverse economic conditions. Overall the indices of NSE have similar reactions, supporting the EMH. This understanding helps in increasing the confidence in market stability during economic uncertainties.

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DETERMINING FINTECH USER BEHAVIOUR AND INTENTION IN SAARC COUNTRIES THROUGH THEORY OF PLANNED BEHAVIOUR PERSPECTIVE

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Abstract *With increased worries about issues in digital financial services, there is a growing need to find long-term solutions targeted at reducing negative effects on clients. In response, FinTech enterprises throughout the world are progressively adopting digital banking solutions. This study seeks to give a complete and systematic examination of financial digital stewardship and its impact on user behaviour among FinTech customers, with the purpose of outlining a research agenda for future studies. The study used Partial Least Squares Structural Equation Modelling (PLS-SEM) analysed with Smart-PLS 4 software to investigate the interrelationships between various factors influencing FinTech User Intention (FUI), drawing on an adapted version of the Theory of Planned Behaviour (Ajzen, 1991) and insights into consumer behaviour when adopting FinTech apps for digital financial services. The findings demonstrated the importance of FinTech's adherence to financial digital stewardship standards in recruiting clients. Several significant positive determinants of FinTech app adoption were identified, including social influence, performance expectations, customer persistence intents, and behavioural tendencies.*

Keywords: *FinTech Apps, Theory of Planned Behaviour (TPB), FinTech User Attitude (FUA), Perceived Behavioural Control (PBC), FinTech User Intentions (FUI)*

INTRODUCTION

Recent advancements in digital financial technology (FinTech) have brought into question the modern-day role of FinTech in financial development of the nation. Traditionally, the banks and financial institutions are the key transactional gateways. FinTech, often known as the convergence of finance and information technology, is revolutionising the banking industry as globalisation and digitalisation accelerate. According to reports from the World Bank and the United Nations, innovative FinTech services can help relieve poverty and boost economic growth because many individuals lack access to financial services. According to (Romānova, 2016), FinTech services have revolutionised the traditional financial industry by offering innovative and user-friendly approaches to capital management, transaction acceleration, and loan acquisition. Through the provision of creative and approachable solutions for financial management, transaction speed, efficiency,

and loan availability, Financial Technology services have revolutionised the traditional banking sector. FinTech refers to a category of financial innovation that is facilitated by technology. It possesses the capability to give rise to novel business models, applications, procedures, or goods that can significantly impact financial markets, establishments, and the provision of financial services (Authority, 2018). FinTech services include peer-to-peer (P2P) lending platforms, digital payment systems, mobile banking, and online investment platforms (Soloviev, 2018; Hendriyani, 2019).

According to (Dapp, 2015) the conventional financial sector has been disrupted by the growth and popularity of FinTech services, which provide clients with more convenient, effective, and customised financial solutions. These services are anticipated to grow and become increasingly important in forming the modern financial landscape due to ongoing technological advancements and heightened competition in the FinTech industry. Through cost reduction, enhanced customer satisfaction, and improved service quality, the

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FinTech sector contributes significantly to the enhancement of the financial system. Financial institutions should focus on developing automated systems for credit evaluation, rejection prediction, and fraud detection in order to achieve this. In this dynamic setting, anticipating user behaviour and spotting potential hazards requires an understanding of data patterns (Li T, 2021). The concept of FinTech was integrated with modern financial services in accordance with the government's digital payment policy, with a focus on Financial Inclusion through consumer behaviour in order to evaluate their service experiences in FinTech apps that have implemented the DFS policy. Digital financial inclusion enables the creation of a sustainable financial system. The government and financial service providers have several opportunities. It promotes economic progress and accelerates real estate sector development.

In the current 4.0 technological era, FinTech will digitally revolutionise and empower society on all fronts. Recent research is essential for creating financial sector investments because of FinTech's explosive growth, which is widely acknowledged as a revolutionary corporate innovation. FinTech services encompass a broad spectrum of innovative financial solutions, including digital currencies, asset management, crowd funding platforms, insurance, and payment technologies. These services stand out for their ability to enhance the financial services customer experience through cost reduction, intermediary elimination, increased transparency, and improved financial data availability (Shiau, 2020). Women's financial inclusion and mindset have a positive and substantial impact on their financial well-being (Vishwakarma, 2024). That affects their intention towards the usage of financial products smoothly.

The South Asian Association for Regional Cooperation (SAARC)

Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, and Sri Lanka are the eight nations that make up SAARC. These nations have witnessed significant advancements as well as challenges in the fields of FinTech and digital banking. In order to promote economic growth, bilateral trade expansion, and mutual collaboration among South Asian nations, the SAARC member states have always operated as an alliance (Gazi, 2022).

- *Diverse Financial Landscapes:* SAARC states have varying economic frameworks, banking systems, and degrees of technological adoption. While certain nations, such as India, have seen tremendous growth in FinTech, others may be in various phases of development.
- *Digital Payment Initiatives:* SAARC nations have implemented digital payment efforts to increase

financial inclusion and minimise cash transactions. Mobile payment solutions, digital wallets, and online banking services have gained popularity, especially in India and Bangladesh.

- *Financial Inclusion Initiatives:* FinTech is essential for advancing financial inclusion, particularly in nations where a sizable portion of the population lacks access to banks. Underprivileged communities and established financial institutions can communicate more effectively thanks to digital banking services and creative payment methods.
- *Difficulties:* The SAARC countries have to deal with issues including inadequate infrastructure, cyber attacks, and the requirement for increased digital literacy. In order for FinTech and digital banking in the area to reach their full potential, these issues must be resolved.
- *Future Outlook:* Advances in technology, changing customer tastes, and increasing knowledge of the advantages of DFS are driving the promising future of FinTech and digital banking in SAARC nations. The environment will be shaped by ongoing initiatives in skill development, regulatory harmonisation, and infrastructural development.

SAARC nations are navigating the shifting terrain of digital banking and FinTech, with various degrees of success. Amidst continuous hurdles, there is a clear possibility for collaboration and development, which might result in beneficial outcomes for the region's financial inclusion and economic advancement. This study intends to perform a detailed assessment of FinTech Users' Beliefs (FUB), Attitudes (ATT), Subjective Norms (SN), and Perceived Behavioural Control (PBC) throughout SAARC countries, while taking into account any variations in user behaviour. Furthermore, the study looks at the interactions between these components and their impact on people's intentions to utilise Internet banking in SAARC countries.

THEORY OF PLANNED BEHAVIOUR

In Theory of Planned Behaviour (TPB), ideas are used to investigate the elements that impact consumers' perpetual intention and behaviour regarding FinTech service usage. Consumer attitudes, PBC, and social comparison all have a substantial and favourable influence on their intends to continue using FinTech apps. Ajzen and Fishbein's Theory of Reasoned Action (TRA), (Davis, 1989) serves as the foundation for the Technology Acceptance Model (TAM), a broad concept that suggests behavioural attitudes influence an individual's social behaviour. (Fishbein, 1967) and (Fishbein, 1975) conducted considerable research on TRA, making it a well-known model for analysing attitudes and

behaviour. Other noteworthy instances are (Liao, 1999) and (Tan, 2000), it used the TPB and innovation diffusion to examine the intention to adopt Internet banking in a global financial centre. Liao et al. suggested that consumers' behavioural intention is controlled by attitude and subjective norm and that TPB only partially explains correlations. PBC was then included to the TPB model to handle circumstances in which people have significantly less control over their behaviour (Ajzen, 1985; Ajzen, 1991; Ajzen, 1886). The early conception of PBC was quite similar to that of Self-Efficacy (SE).

This emerging approach emphasises a complex knowledge of the elements that influence behaviour, highlighting the need of recognising and distinguishing the impact of personal efficacy beliefs on behavioural outcomes within the larger framework of perceived control. The literature has dug into the complexities of this special dimension, providing light on its distinctive contributions to a better

understanding of human behaviour and motivation. Researchers have investigated the ramifications of this revised viewpoint on PBC, providing insights into how it influences people's actions and decision-making processes (Terry, 1995). Surprisingly, subjective norms have little influence on consumers' continued intends to use FinTech apps. In another study done through TPB, it was quoted that the desire to donate is greatly influenced in a favourable way by variables including attitude, perceived behavioural control, subjective norms, self-identity, and cognitive trust (Meghana, 2024). This study has major significance for marketers who want to develop marketing strategies for creating and maintaining the FinTech brand. Despite a wealth of research on consumer behaviour in online banking, the bulk of studies have been undertaken in countries other than those covered by this study. As a result, this study addresses a significant gap in our understanding of consumer behaviour in relation to FinTech usage in the targeted locations (Fig. 1).

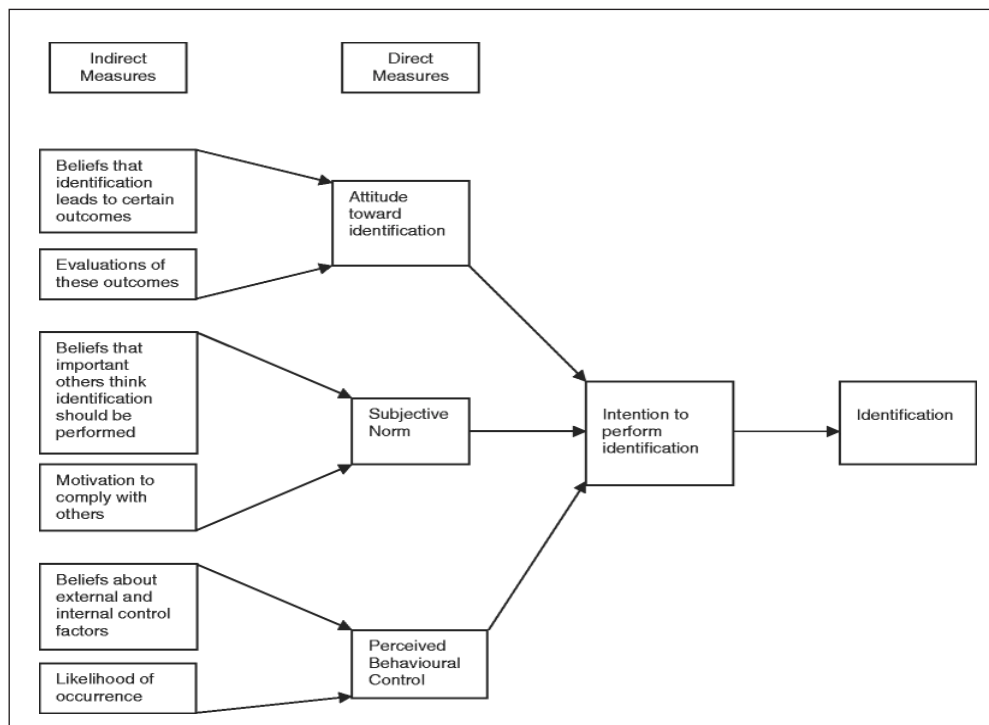


Fig. 1: Theory of Planned Behaviour

LITERATURE REVIEW

We did a thorough literature study to reflect the lack of conceptual clarity on the relationship between financial digital stewardship solutions and FinTech customers' user behaviour.

In this study, he emphasises the theory of planned conduct's usefulness as a conceptual framework for comprehending

the intricacies of human social interaction (Ajzen, 1991). The theory, which combines key notions from the social and behavioural sciences, assists in the prediction and interpretation of specific acts in specified conditions. The hypothesis is strong and accounts for a significant portion of behavioural variance, as evidenced by the predictive power of attitudes (ATT), subjective norms (SN), and perceived control over intentions (PBC).

(Bajunaied, 2023) The study investigates the effects of several variables on customers' behavioural intentions toward FinTech apps services in Jeddah, Saudi Arabia. It builds on the UTAUT concept by including privacy enablers and inhibitors. The study validates the expanded UTAUT model as an appropriate theoretical framework for analysing user intentions in the Saudi setting. Overall, the results show a positive and substantial association between most dimensions, demonstrating that customers are confident in adopting FinTech services. However, social influencers and privacy inhibitors were shown to have no effect on behavioural intention. In contrast, performance expectation, effort expectancy, enabling environments, and privacy enablers all have a favourable effect on customers' behavioural intentions toward FinTech services in Saudi Arabia.

MZ Hoque's (2024) study addresses the absence of research on the influence of social, enabling, and socio-demographic characteristics on FinTech user intention, particularly in the context of the gender gap. Using an ordered logit model, it finds image, perceived behavioural control, and compatibility as significant factors influencing FinTech adoption. Notably, image has a stronger positive influence on female user intention, but PBC has a negative impact. Self-employed individuals and experienced users are more likely to use FinTech. A supportive regulatory environment is critical for fostering innovation and aligning FinTech with traditional financial services in order to drive good uptake.

Abbasi (2017) reveals a sizable vacuum in the body of research on how Digital Financial Services (DFS) have affected company performance in the last ten years. Even with DFS's quick technical progress, there were very few relevant publications found, and most of them focused primarily on the banking industry. Stunted advancement in this subject is also caused by the regulation of non-banking companies, such as mobile network carriers involved in branchless banking, and the inclination of younger academics to repeat earlier studies.

Senyo's (2020) study looked at the factors that influence actual use of mobile money (MM) services by merging the UTAUT2 and their Prospect theories in a unique approach. The study's outcomes demonstrated how effectively the research model predicted behavioural intention and mobile money service usage. The study also found several unexpected results, such as the negative impacts of perceived risk on agent and mobile money service trust, as well as the positive benefits of mobile money service trust on enabling conditions. Some findings challenged prior research, stressing the insignificance of price value, hedonic incentive, enabling conditions, perceived risks, and social influence on behavioural intention and actual use of mobile payment services.

Gomber's (2017) study concludes by offering a thorough overview of the rapidly changing field of digital finance and analysing the plethora of new financial products, companies, software, and consumer engagement methods made possible by FinTech companies. The study emphasises how important it is becoming to comprehend how information systems and finance interact in the context of digital innovations.

Singh (2020) emphasises how important perceived utility and social influence are in determining behavioural intention (BI) to use FinTech services, even while social influence has a noticeably detrimental effect. Conversely, perceived utility and behavioural intention may not always impact actual usage; rather, social influence and simplicity of use play a major role. Digital behaviour and technology characteristics interact to greatly impact behavioural traits, and age stands out as a critical element influencing users' perceptions of security, especially those who are older. By including pertinent technological and behavioural traits, this study not only improves the body of research on technology adoption, but it also investigates the influential impact of digital user behaviour and their demographic traits.

Ya-Yueh Shih (2004) concluded that the finding has some crucial ramifications for practice and research. Using a deconstructed TPB model—based on the Diffusion of Innovations theory—instead of the conventional Theory of Reasoned Action (TRA) to analyse the intention to adopt Internet banking is a new method that has not been extensively studied before. The finding reflects the need for dissecting belief systems into several facets in order to gain a more complex comprehension of these connections.

(Ryu, 2018) finds consumers' perceived advantage and risk have a major impact on their desire to continuously using FinTech Apps. Perceived gain has a favourable effect on FinTech continuation intention, but perceived danger has a negative impact. The findings also revealed that the perceived advantage had a greater influential impact on FinTech usage decisions than the perceived danger. These insights can assist practitioners in identifying which elements to emphasise or avoid while providing FinTech to consumers.

OBJECTIVES

- To examine the implications of the theory of planned behaviour (TPB) on FinTech user behaviour in SAARC nations.
- To examine the link between the elements that influence FinTech user intention (FUI) using the Theory of planned behaviour (TPB).
- To examine the link between the elements that influence FinTech user behaviour (FUB) using the Theory of planned behaviour (TPB).

HYPOTHESIS

H1a: FUA has a substantial effect on FUI among users in SAARC nations.

H1b: FUA has a substantial effect on FUB among users in SAARC nations.

H2a: SN has a substantial effect on FUI among SAARC users.

H2b: SN has a substantial effect on FUB among SAARC users.

H3: FUI has a substantial effect on FUB among users in SAARC countries.

H3a: PBC has a substantial effect on FUI among SAARC users.

H3b: PBC has a substantial effect on FUB among users in SAARC countries.

H4: FUI mediates FUA and FUB among SAARC users.

H5: FUI mediates SN and FUB among SAARC users.

H6: FUI mediates PBC and FUB among SAARC users.

METHODOLOGY

Design and Data Collections

In this research, sample data were gathered by a well-established quantitative research method, namely an online survey-based questionnaire. The questionnaire was created into two sections, including questions regarding five components, i.e., FUI, FUB, FUA, SN, and PBC, as well as additional demographic profile information. The demographic questions included gender, age, education level, monthly FinTech payments, region of residence, and

preferred payment methods. The assessment was conducted using a 7-point Likert-scale. The study looked at both primary and secondary data. The snowball technique was utilised to collect data, with a specifically designed questionnaire acting as the foundation. There were 265 valid responses from FinTech users who are SAARC nationals. PLS-SEM was utilised to study the mediating effect of user intents on FinTech. In the subsequent analytical step, Smart.PLS and SPSS were employed. Rigorous tests were employed to rigorously assess the validity of hypotheses, resulting in a robust and comprehensive analysis of the collected data.

Conceptual Framework

In this study, the conceptual model for FinTech, based on the Theory of Planned Behaviour, includes many essential factors: FinTech users’ perceived behaviour control, subjective norms, FinTech user attitudes, and FinTech user intentions, all of which have a substantial impact on FinTech user behaviour. FUA shows the end user’s positive or negative feelings about a particular activity. SN expresses perceived social pressure to perform or refrain from specific activities while taking into consideration society norms. PBC assesses an individual’s perceived ease or difficulty in completing a specific activity (Ajzen, 1991). Actual consumer adoption of digital financial products is highly determined by their FinTech user goals. FUI indicates an individual’s willingness to participate in a given action and is a direct predictor of behaviour. In this study, “FinTech User Behaviour” refers to the willingness to continue using digital financial goods and embrace current developments in this sector. Ajzen’s Theory of Planned Behaviour (TPB) was used to investigate the link between FinTech app users and their usage activities, with FUA, PBC, and SN serving as predictors, FUI as a mediator, and FUB as the dependent variable. Fig. 2 depicts the architecture of the finished conceptual framework.

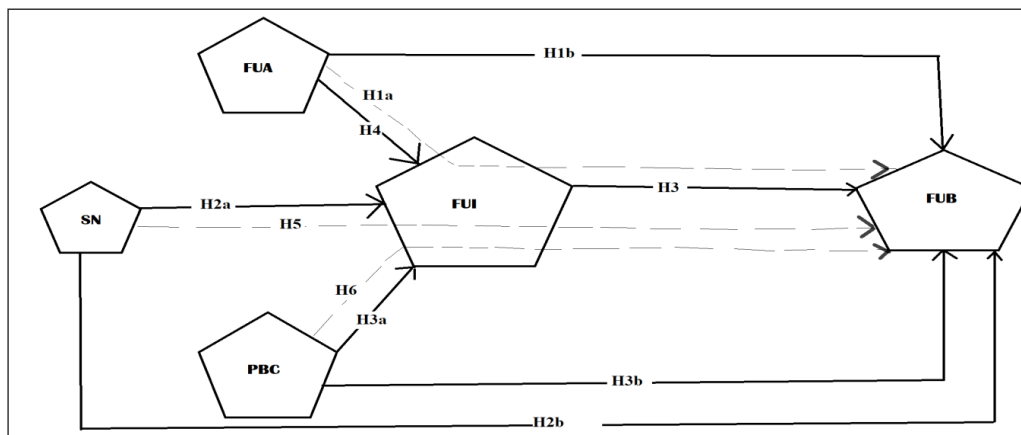


Fig. 2: Compiled Conceptual Research Framework by Researcher

ANALYSIS AND ITS FINDINGS

Reliability and Validity

First, the SPSS was used for a range of statistical analyses, including managing missing data and normality evaluations. It has been acknowledged that PLS-SEM is a useful method for doing prediction analyses and hypothesis testing. In

investigations with small sample numbers, it is typically thought to be better than CB-SEM (Reinartz, 2002). As a result, for modelling and testing in this investigation, we used the Smart-PLS 4 program (Ringle, 2014). This study used a priori measuring models, as described by (Chin, 1998), (Bollen, 2011), and (Saunders, 2006), to assess the validity and precision of the constructs before doing the structural model analysis.

Table 1: Results

Variables	Elements	Outer Loading	Delete	Variance Inflation Factors	Cronbach's Apha	Average Variance Extracted	Composite Reliability
FUB	FUB1	0.731	N	1.791	0.895	0.662	0.905
	FUB2	0.611	Y	-	-	-	-
	FUB3	0.768	N	2.084	-	-	-
	FUB4	0.778	N	2.178	-	-	-
	FUB5	0.439	Y	-	-	-	-
	FUB6	0.813	N	3.351	-	-	-
	FUB7	0.688	Y	-	-	-	-
	FUB8	0.851	N	4.532	-	-	-
	FUB9	0.856	N	3.017	-	-	-
FUI	FUI1	0.845	N	2.677	0.939	0.802	0.940
	FUI2	0.86	N	2.859	-	-	-
	FUI3	0.92	N	3.959	-	-	-
	FUI4	0.937	N	7.078	-	-	-
	FUI5	0.921	N	6.633	-	-	-
PBC	PBC1	0.866	N	2.11	0.863	0.788	0.867
	PBC2	0.909	N	2.49	-	-	-
	PBC3	0.881	N	2.21	-	-	-
SN	SN1	0.944	N	4.831	0.946	0.907	0.950
	SN2	0.967	N	6.722	-	-	-
	SN3	0.924	N	4.347	-	-	-
FUA	FUA1	0.929	N	6.862	0.958	0.892	0.959
	FUA2	0.937	N	5.923	-	-	-
	FUA3	0.899	N	3.198	-	-	-
	FUA4	0.938	N	4.946	-	-	-
	FUA5	0.921	N	4.891	-	-	-

All of the variables that were analysed i.e., FUA, FUB, FUI, SN, and PBC—had Cronbach's α values that were greater than 0.70, according to the analysis shown in Table 1 (FUB 0.895, FUI 0.939, FUA 0.958, SN 0.946, and PBC 0.863). Furthermore, the composite reliability was higher than 0.70 and the convergent validity was higher than 0.50, both of which met (Hair, 2012) requirements. These results indicate strong validity and reliability, while Cronbach's α values above 0.9 imply very good questionnaire reliability. Table 2 shows that significant correlation t-tests were found,

and the square root of each construct's AVE surpassed its correlations, highlighting differential validity according to the Fornell-Larcker criteria (Claes Fornell, 1981). Moreover, every indicator loading exceeded the cross-loadings, highlighting the differential validity (see Table 3). Additionally, we thoroughly evaluated covariance for the observed model as well as the baseline measurement model. We examined the variance inflation factors (VIFs), which are useful in identifying numerous covariance difficulties, in order to resolve probable covariance concerns. According

to (Joseph Hair, 1995), a VIF of less than 10 confirms the sufficiency of covariance by indicating that multicollinearity issues are not present. According to Table 1, the VIF value in our analysis stayed comfortably below the threshold

at 7.07. As a result, we can state with confidence that the measurement model used in this investigation is valid and reliable.

Table 2: Fornell-Larcker Criterion - Discriminant Validity

	FUA	FUB	FUI	PBC	SN
FUA	0.924				
FUB	0.358	0.799			
FUI	0.661	0.599	0.896		
PBC	0.317	0.264	0.359	0.891	
SN	0.441	0.638	0.519	0.398	0.959

Table 3: Cross Loadings - Discriminant Validity

	FUA	FUB	FUI	PBC	SN
FUA1	0.929	0.327	0.675	0.256	0.402
FUA2	0.937	0.325	0.655	0.296	0.386
FUA3	0.899	0.359	0.602	0.241	0.393
FUA4	0.93	0.332	0.581	0.295	0.361
FUA5	0.921	0.31	0.642	0.298	0.385
FUB1	0.282	0.731	0.442	0.135	0.423
FUB3	0.266	0.768	0.435	0.121	0.487
FUB4	0.288	0.778	0.491	0.089	0.514
FUB8	0.31	0.851	0.537	0.225	0.592
FUB9	0.341	0.856	0.541	0.194	0.558
FUI1	0.523	0.569	0.845	0.291	0.459
FUI2	0.572	0.416	0.861	0.290	0.415
FUI3	0.520	0.548	0.921	0.324	0.542
FUI4	0.573	0.524	0.937	0.331	0.536
FUI5	0.627	0.526	0.921	0.358	0.545
PBC1	0.365	0.101	0.369	0.866	0.248
PBC2	0.302	0.263	0.371	0.909	0.34
PBC3	0.364	0.279	0.326	0.881	0.33
SN1	0.359	0.625	0.536	0.295	0.944
SN2	0.319	0.615	0.598	0.35	0.967
SN3	0.444	0.626	0.586	0.327	0.924

Hypothesis Testing and Structural Modelling

Three main criteria, as described by Chin (1998), were used in this work to evaluate structural models: path coefficient and t-values, R², and Q². At first, the analysis concentrated on the importance of path coefficients and R². With R² values of 0.549 and 0.575, respectively, FUB and FUI demonstrated strong predictive accuracy, as shown in Table 4. In accordance with (Stone, 1977)'s technique, Q² scores were used for cross-validation by blind sampling in order to further evaluate the predictive relevance of components.

Notably, FUB and FUI had Q² scores of 0.368 and 0.451, respectively, demonstrating strong predictive relevance. Further, the SRMR value of 0.039 satisfied the criterion of being less than 0.08. This indicates that the structural equation model developed by TPB is appropriate for explaining the connection between FUB and its effects on educated individuals, and it is in line with empirical findings. Table 4 provides a summary of these findings:

(R₂) denotes coefficient of determination.

(Q₂) denotes the Stone-Geisser criterion.

(SRMR) denotes Standardised Root Mean Square Residual.

Table 4: Hypothesis Testing and Results

Hypothesis	Effects	Direct/ Indirect Effects	Significance	t-Value	Result
H1a	FUA on FUI	0.479	0.000	7.26	Supported
H1b	FUA on FUB	0.002	0.111	1.17	Not Supported
H2a	SN on FUI	0.398	0.000	5.45	Supported
H2b	SN on FUB	0.517	0.002	7.09	Supported
H3	FUI on FUB	0.439	0.000	6.11	Supported
H3a	PBC on FUI	0.203	0.021	2.17	Supported
H3b	PBC on FUB	0.01	0.002	2.21	Supported
H4	FUA on FUB through FUI	0.221	0.000	5.36	Supported
H5	SN on FUB through FUI	0.146	0.001	3.38	Supported
H6	PBC on FUB through FUI	0.051	0.043	2.91	Supported

The study produced some important conclusions on the correlations between various factors, which are shown in Table 4. First, the hypothesis indicating a direct relationship between them was rejected when it was shown that FUB (FinTech User Behaviour) was not significantly influenced by FUA (FinTech User Attitude) (H1b = 0.002, p = 0.111). This implies that variations in FinTech User Attitude within the sample under study cannot be consistently linked to variations in FinTech User Behaviour. As a t-value of more than 2, which is commonly regarded as a standard for statistical significance, H1b’s t-value is 1.17, and as we know that t-statistic less than 2 indicates a tiny effect size and a weak or non-existent association between FUB and FUA. This serves as evidence that the data does not point to a significant relationship between user attitude and behaviour with regard to FinTech. Nonetheless, FUB (H2b: = 0.517, p = 0.002) and FUI (FinTech User Intention) (H2a: = 0.398, p=0.000) showed a clear and beneficial influence from SN (Subjective Norms). In a similar vein, PBC (Perceived Behavioural Control) showed favourable correlations with FUB (H3b: = 0.01, p = 0.002) as well as FUI (H3a: = 0.203, p = 0.021). Moreover, a positive correlation between FUB and FUI was discovered (H3: = 0.439, p = 0.000). The indirect effects of FUA, SN, and PBC on FUB through FUI were also investigated in the study, and all of the assumptions made about these indirect effects were found to be true.

CONCLUSION

The TPB was employed in this study to look into FinTech user behaviour among consumers in SAARC countries. Our studies showed that the predictor structure has a significant impact on consumers’ inclination to use digital financial products, which in turn influences their actual usage behaviour. Despite these findings, we uncovered numerous results that differ from previous research and deserve more discussion. Customers regularly chooses FinTech

applications for digital payments and other financial services-related utilities, indicating an influence on usage behaviour. We provide three things that should be considered.

First, the study revealed a substantial relationship between FinTech User Behaviour (FUB) and PBC, with a statistically significant path coefficient of 0.01 (p = 0.002). This research indicates that consumers in the SAARC area have a slight but significant influence in predicting the usage patterns of FinTech applications when it comes to their perception of their ability to manage behaviour. The idea that “Behavioural achievement jointly depends on motivation (intention) and ability (behavioural control)” is supported by our research (AB Frare, 2023). This finding suggests that consumers could be concerned about concerns related to financial digital stewardship and that they may not feel fully equipped to control or influence the procedures and results of using FinTech applications. Moreover, it suggests that certain users may have limitations and difficulties when using FinTech apps, which might result in a decrease in real interaction with FinTech platforms. Subsequent investigations might probe more deeply into the particular factors causing these limitations and challenges, investigating ways to lessen their influence on FinTech user behaviour. Consumers may benefit from improved financial digital stewardship experiences by resolving these problems, which will increase involvement and engagement in FinTech initiatives.

Second, the research showed that the opinions of FinTech users in the SAARC countries had no direct bearing on how they used the technology. This implies that user behaviour is not entirely determined by attitude (ATT) alone. This finding may result from the intricate interactions between several elements that shape consumers’ opinions about FinTech apps, which extend beyond their impressions of digital financial services. Subsequent investigations may seek to classify users according to distinct analytical vantage points in order to reveal differences in the way that users

utilise DFS within the framework that has been suggested. Through a closer examination of these subtleties, scholars might acquire a more all-encompassing comprehension of the elements influencing FinTech usage trends across various user groups in SAARC countries. The denial of H1b suggests that customers' sentiments regarding FinTech do not substantially affect their actual user behaviour within the setting of SAARC nations. There are several possible reasons for this discovery: *Cultural and Economic Diversities*: The SAARC nations have a wide diversity of cultures and economic backgrounds, which might have an impact on how views become actions. These nations differ significantly in terms of things like access to FinTech services, technical infrastructure, and economic stability. *External Influences*: In addition to personal views, other external variables that may have a greater influence on FinTech user behaviour include governmental policies, regulatory regimes, and market maturity. *Measuring Attitudes and Behaviours*: A weaker association may have resulted from the study's measurement of attitudes and behaviours, which may not have adequately reflected contextual variations or subtleties. The results did not support the hypothesis that FinTech User Attitude had a significant impact on FinTech User Behaviour among users in SAARC nations. This demonstrates the intricacy of FinTech adoption in the area and raises the possibility that user behaviour is more significantly influenced by other variables.

In conclusion, our mediation study revealed that although the attitudes of FinTech app users (ATT) do not influence their behaviour directly, individuals who have higher levels of FinTech User Attitude (FUA) and financial understanding and awareness are more likely to have greater FinTech User Intentions for its usage. This highlights a greater desire to obtain digital financial goods, which in turn impacts FinTech user behaviour. Furthermore, in SAARC countries, the association between FinTech User Behaviour, Subjective Norms (SN), Perceived Behavioural Control (PBC), and FinTech User Attitude is modulated by FinTech User Intentions.

The study's findings, taken together, confirm that the TPB is applicable when discussing digital financial consumption in developing countries. This has important ramifications for corporations and governmental entities alike. By learning more about how FinTech application users behave and engage with digital financial goods, businesses may better target their targeted audience and improve their marketing tactics. In light of FinTech's fast expansion, attaining financial inclusion is critical, since roughly 3 billion people worldwide remain beyond the reach of traditional financial services. In India, a country at the forefront of FinTech innovation, 135 million households remain without access to official financial services, following only China. Despite the fact that around 34% of the population has access to

formal banking, India's real level of financial inclusion remains low, with 40% of bank account holders failing to use their accounts on a regular basis (Alokik Dixit, 2023). The results also provide insight into how SAARC countries' DFS providers have modified their operations in reaction to growing awareness of possible FinTech effects. Governments may also utilise these findings to design legislation that encourage FinTech users to use financial technology responsibly, which will increase financial inclusion and stewardship.

LIMITATIONS

While this study greatly advances our understanding and development of FinTech services, it must be acknowledged that it has limits. The study was mostly carried out fully online in SAARC nations, with no in-person participant contacts. As a result, the knowledge gained may be impacted by socioeconomic differences in each nation, which might limit the findings' generalisability to other countries. In order to account for these contextual variations, it is imperative that future research projects focus on identifying the unique characteristics influencing user behaviour in each particular area.

RECOMMENDATIONS

The current study looked at the influence of planned behaviour theory factors on the shift in behaviour toward DFS among FinTech users in SAARC countries. This link was specifically investigated in terms of behavioural persuasion and motivation. However, due to the online manner of data collecting used in this study, which adopted the snowball technique, reaching all nations for personal recommendations proved difficult, resulting in inadequate data. Some respondents showed low involvement, which might lead to inaccuracies in their replies. Notably, their behaviour differed from that of the original target group, which consisted of individuals who freely opted to utilise DFS based on their position as FinTech users in SAARC nations. As a result, it is advised that future studies take a more traditional method, using interview techniques to collect data directly from service providers and FinTech customers region-wise. By doing this, a more thorough grasp of the many factors influencing FinTech uptake and usage in various geographic and socioeconomic situations may be obtained. This technique seeks to analyse their work habits and compliance with government rules under regular circumstances. It is also recommended to integrate other digital financial elements such as security, 24-hour access, rapid fund transfers, anytime access, and tailored user experience. This feature is recommended to improve

our understanding of consumers' profound insights into the aspects that influence FinTech user intents and results. This report serves as a resource for policymakers and FinTech firms developing strategies for digital payments and financial digital stewardship.

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AN APPLICATION OF ISM AND MIC-MAC APPROACH TO MODELLING FACTORS INFLUENCING THE INTENTION TO ADOPT DIGITAL WALLETS

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Abstract *Purpose: The present study ascertains the most influential determinants influencing the digital wallets' intention and adoption among Delhi youths. This paper is carried out in assistance with the factors of the Technology Acceptance Model (TAM). Additional influencing factors such as user experience, government/ regulatory support, innovation, continuous digitalisation, ICT awareness, security, transparency, and trust are also considered. Design/Methodology/Approach: The determinants of adoption of digital wallets are collected using literature review analysis. ISM and MIC-MAC analysis identifies and analyse the influencers affecting intention or adoption of digital wallets. This integrated model depicts how the many influencers are related to one another. Findings: The crucial observation—which makes it abundantly evident that there are important aspects influencing the adoption of digital wallets—is highlighted by the suggested model. To explicitly state: user experience is observed as a significant factor, followed by security, government/ regulatory support and, perceived risk. Lastly, others are noticed as secondary factors to adopt digital wallets, i.e., perceived ease of use, innovation, perceived usefulness, social influence, continuous digitalisation, ICT awareness, transparency, and trust (Tang et al., 2022).*

Keywords: Digital Wallets, Digital Payments, ISM, MIC-MAC Analysis

INTRODUCTION

The trend of application and adoption of digital payments is elevating rapidly with the development of ICT infrastructure and ICT awareness. In today's cashless era, the proliferation of digital technology and digitalisation of financial services have developed speedily, marked by the birth of electronic payment system as an important mode of payment and a new payment way to modern lifestyle (Aggarwal & Patel, 2023).

For instance, in India, every mobile user has PayTM installed in their mobiles. Large corporate buildings, shopping centres, and tiny local businesses all agree on the importance and usage of digital wallets.

Significance of Digital Wallets

It is impossible to deny the widespread use of digital wallets in India. The Indian government's recent audacious move to demonetise all of the old 500 and 1000-rupee notes has generated a lot of controversy around the country. There was a cash constraint as a result of the Indian Prime Minister Narendra Modi Ji's unexpected call, which took almost all of the public's money. Such a crisis has made Indians to think seriously for adopting digital wallets in daily life. The public stated showing their interest in knowing about digital wallets. This has made Indians to adapt the digital platform for making online payments with ease.

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Digital platforms like PayTm, Mobikwik, PayPal, Ola Money, Airtel Money, UPI, etc. are showing their maximum usage by mobile users. Digital wallets can manage all your easy to difficult finances with one click, and one can even make it more secure than your banks (Tom, 2021). It assures all types of facilities to settle all your amounts online as well as offline transactions with ease (IBRAHIM et al., 2022).

LITERATURE REVIEW

Mew and Millan (2021). This study identified the key factors that encourage and hinder the use of mobile wallets. The results validated the critical importance of every element taken into account in the model: they affected customers' desire to use the mobile wallet either directly or indirectly and partially explained its variation.

Ajmera, Hiteshi, Bhatt and Viral (2020) examined how the use of e-wallets was impacted by categorical characteristics such as gender, age, occupation, income, education, and qualification. Additionally, the researcher evaluated the uptake of digital wallets with TAM factors of perceived advantages, perceived trust, perceived service quality, and perceived satisfaction.

Aransyah, Roy and Aprianti (2020, March) aimed to provide an elaborative review of the Innovation Resistance Theory (IRT) that consisted of Use, Value, Risk, Tradition, and Image Barrier to investigate e-wallet resistance. The study underlines the perceived novelty factor, hence, focusing on mobile application and e-wallet services. It is essential to provide a baseline for future e-wallet services to accommodate user needs and increase e-wallet utilisation.

Karim, Haque, Ulfy, Hossain and Anis (2020) stated an elevated increase in cashless transactions due to the growth and development of financial technology. They examined the significant influencing factors for Malaysian youths for usage of e-wallet by applying the extended Technology Acceptance Model (TAM). Partial least squares structural equation modelling was used to examine the data from 330 respondents who were e-wallet users in the Klang Valley of Malaysia (PLS-SEM). The study's conclusions showed that behavioural intention to use an e-wallet has a positive and substantial association with perceived utility, perceived ease of use, privacy, and security.

Tripathi (2020) identified the consumer's attitude with reference to usage and applications of mobile payment in aspect of the influential factors in regard to Gujarat state. When it comes to demographic characteristics, occupation has a very little role in decision-making. Seniors, for example, are not at all drawn to using mobile payment applications for digital payments or education, whereas undergraduates

and postgraduates are more drawn to these platforms. It also discovered several obstacles preventing the use of mobile applications.

Dahlberg, Mallat and Öörni (2003) explored and designed the model to exhibit vital consumer insights which influence mobile payment systems. In particular, TAM has been used for describing user acceptance of technology which offers an inclusive explanation for consumer decisions related to mobile payments. The analysis suggested that TAM is a sound model to explain use of mobile payment solutions and proposed a construct of trust to extend the present influencing factors in generalising consumer's adoption choices.

Tiwari, Garg and Singhal (2019) investigated the usefulness of this product in the current scenario as well as the willingness of peoples to adopt this digital innovation. Respondents will prefer if only repair cost.

Sivananthan (2019) focused on the digital payment systems during India's demonetisation period. He discovered that Innovation Resistance (IR) and Behavioural Intention (BI) were more impactful. The stickiness to cash payments moderates their relationship.

Akhila Pai H. (2018) determined how consumers felt about digital wallets by looking at how they responded to three factors: readiness to use, awareness, and perceptions. In particular, research was done on awareness, usage, and the propensity to use cellphones to complete financial transactions. The popularity of digital wallets is expanding as more people have access to the internet. As a result, there are now more people using digital wallets. Digital wallets are becoming more and more common among young people, including workers and students, according to the findings. The survey also found that, in comparison to other e-wallet providers, Paytm is in the lead. One of the biggest problems seen is security, which occasionally makes people afraid to give sensitive information for fear that it will be discovered. Therefore, digital wallet providers need to be aware of the user's expectations and level of trust. The use of digital wallets is increasing, and customers are placing more and more faith in the digital system to expedite and improve processes.

Chakraborty and Mitra (2018) found whether customer demographics influence adoption intention for e-wallets in India and to identify the parameters that are most important in predicting consumers' adoption intention and whether the market can be segmented into different customer groups. The regression model showed an impressive amount of variance explained for adoption intention ($R^2 = 81.7\%$). These findings helped digital wallet companies to have a better and clear understanding of influencing determinants the adoption decision of Indian consumers concentrating

particularly on the parameters that influence end-users to adopt their services.

Singh Srivastava and Sinha (2017) noticed the important connection between mobile wallet users' perceptions, preferences, and levels of satisfaction. Additionally, this study looked at how customers' perceptions, preferences, and levels of satisfaction with mobile wallets were affected by their age and gender. It was also investigated how perception, preference, and satisfaction affected the rate at which mobile wallets were used. The results showed that preferences have a considerable influence on usage, meaning that customers' preferences for particular transaction types may increase the use of mobile wallets in northern India. The factors: use, trust, social norms, attitude, and security significantly affected the degree of preference, suggesting that if an app is reliable, safe, and simple to use. The most useful variables to determine the utilisation rate are hedonism, social norms, self-efficacy, and usefulness, as the results have clearly demonstrated. This claimed that customers will use wallets more frequently if they are appealing and easy to use.

Rathore (2016) discovered that out of 150 buyers, digital wallet usage is rapidly becoming the norm for online payment methods.

Pachare and Smita (2016) stated in her study that the war for digital wallets and their providers is about to come to an end as a result of demonetisation (Unpacking the Digital Wallet). With the aid of secondary data, retailers, customers, and the market are prepared for the widespread use of digital wallets.

Kapoor et al. (2015) examined the role and significance of innovation attributes consisting of three sets for ascertaining IMPS application adoption. IMPS was shown to be strongly predicted by cost and behavioural intention; observability, visibility, image, and riskiness were identified as unimportant adoption qualities.

RESEARCH METHODOLOGY

Objective of the Study

- To explore the influencing factors for adoption of digital wallets in Delhi region.
- To ascertain the extent level of most influential factors out of multiple factors for digital wallet's adoption.

Data Collection and Analysis

- Literature review is done to extract the significant influencing factors for adopting digital wallets.

- ISM and MIC-MAC analysis model is used.
- It is applied to interpret the factors affecting intention to use digital wallets. This illustrates the inter-relationship among the different influencing factors.

CONCEPTUAL FRAMEWORK

There are certain factors which affects intention in adopting the digital wallets among the youth generation of Delhi-NCR. In context with this, following influencers are identified to know the usage of digital wallets among Delhi youths (Aurazo & Vega, 2021).

Influencing Factors in Adoption of Digital Wallets

- *Perceived Ease of Use*
Yi and Hwang (2003) anticipated the use of a 'web-based information' protocol is highly inclined by learning goals, self-efficacy, enjoyment on technology acceptance.
Churchill (1991) stated that activities which consume less time need to be realised.
- *Perceived Risk*
The perceived risk concept elaborates the user's perception on the possible risk factors. According to Bauer, perceived risk is "a combination of uncertainty plus seriousness of outcome involved".
- *Perceived Usefulness*
In order to help determine the behavioural intention to utilise information technology, Davis (1989) created the TAM model. According to Jaruwachirathanakul et al. (2005), Thai customers are more likely to accept web banking when they believe it to be beneficial. (Sarabhai & Meena, 2023).
- *Social Influence*
Adapting to and staying current with new technology is essential for survival in today's cutthroat world. Social influence has an impact on modern technology used in daily life (Venkatesh, 2000). According to Sudeep (2007), integrating cutting-edge and novel technology has a social impact on users as it makes them feel more a part of the modern world.
- *User Experience*
User experience majorly impact the user. And leaves a huge impact on the user. A user generally prefers to adopt a simple, easy, transparent, and reliable user interface. Unified integration to net-banking websites and e-payment gateways are required for hassle-free transactions. (Agarwal & Khatri, 2022).

- *Government/Regulatory Support*

Government or regulatory support for digital wallet innovation during this COVID-19 outbreak and demonetisation also positively influenced intention to use digital wallets (Jain, Shivnani & Jampala, 2023). WHO's advised (Brown, 2020; Huang, 2020), the government should inspire its public to engage in digital wallet payments. It is supporting to "flatten the curve" (Kaur, 2020).

- *Innovation*

Technology and a paradigm shift in the regulatory environment have acted as a catalyst for wallet innovation. (Rachmatika et al., 2023). Digital wallets are driven by innovation, which is continuously improving functionality, security, and user experience (Shetu, Islam & Promi, 2022). Transactions are becoming quicker, more secure, and more convenient thanks to new technologies like biometric verification, blockchain integration, and AI-powered personalisation.

- *Continuous Digitalisation*

Digitalisation of payments has paved the way to transfer money in just one-tap. India is moving forward to the aim of "cashless society" by adopting different modes and mechanisms of digital payments (Goh et al., 2022).

- *ICT Awareness*

ICT awareness, here, in general, implies spreading awareness about the pros and cons, usage, and benefits of using digital wallets. Today's modern world is digitising with an advantage of ICT awareness and thus, emerging as a paperless economy (Rachmatika et al., 2023).

- *Security*

Security is the utmost concern of the majority of the digital banking users. A safe and secured banking system builds trust. With digital innovation's data confidentiality, privacy, and security, customer trust is freezing day by day (Shetu et al., 2022).

- *Transparency*

It is essential for survival in the competitive world of today to adapt and stay contemporary with emerging technologies. Social impact influences how modern technology are used for daily tasks (Venkatesh,

2000). According to Sudeep (2007), users who have a feeling of closeness with the modern world are impacted socially by the integration of cutting-edge and ingenious technology.

- *Trust*

Trust is identified as a critical challenge of e-payment. According to Pavlo, trust is "a defining feature of the major social and economic interactions in which uncertainty is present".

INTERPRETIVE STRUCTURAL MODELLING (ISM)

Introduction of Interpretive Structural Modelling (ISM)

In this technique, related distinguished sets of elements are arranged into an organised model. A contemporary, well-researched method for categorising relationships among certain components that characterises an issue is called "Interpretive Structural Modelling". However, the situation is significantly more accurately described by the relationships, either direct or indirect, between the elements than by taking each factor alone. As a result, ISM enhances our understanding of how these relationships are understood collectively.

Structural Self-Interaction Matrix

SSIM defines the relationships between two elements - i and j . SSIM, as presented in Table 1, was produced based on an evaluation of our research and understanding.

The symbol representation to recognise the direction of variable relationships is defined as follows:

- V is denoted for the association from an element i to element j , but not in both directions.
- A is denoted for the association from an element j to element i , but not in both directions.
- X is denoted for both the directions, associations from an element i to j and j to i .
- 0 (zero) is denoted if the association between the elements is not valid.

Table 1: Structural Self-Interaction Matrix (SSIM)

	<i>12</i>	<i>11</i>	<i>10</i>	<i>9</i>	<i>8</i>	<i>7</i>	<i>6</i>	<i>5</i>	<i>4</i>	<i>3</i>	<i>2</i>	<i>1</i>
<i>1</i>	<i>V</i>	<i>A</i>	<i>O</i>	<i>O</i>	<i>A</i>	<i>A</i>	<i>O</i>	<i>V</i>	<i>V</i>	<i>A</i>	<i>A</i>	-
<i>2</i>	<i>V</i>	<i>A</i>	<i>V</i>	<i>O</i>	<i>A</i>	<i>A</i>	<i>O</i>	<i>V</i>	<i>V</i>	<i>V</i>	-	
<i>3</i>	<i>V</i>	<i>A</i>	<i>O</i>	<i>O</i>	<i>A</i>	<i>A</i>	<i>O</i>	<i>V</i>	<i>V</i>	-		
<i>4</i>	<i>A</i>	<i>A</i>	<i>O</i>	<i>A</i>	<i>A</i>	<i>O</i>	<i>O</i>	<i>V</i>	-			
<i>5</i>	<i>A</i>	<i>A</i>	<i>O</i>	<i>A</i>	<i>A</i>	<i>A</i>	<i>O</i>	-				
<i>6</i>	<i>V</i>	<i>V</i>	<i>V</i>	<i>O</i>	<i>A</i>	<i>A</i>	-					
<i>7</i>	<i>V</i>	<i>V</i>	<i>V</i>	<i>V</i>	<i>V</i>	-						
<i>8</i>	<i>O</i>	<i>A</i>	<i>A</i>	<i>A</i>	-							
<i>9</i>	<i>O</i>	<i>A</i>	<i>O</i>	-								
<i>10</i>	<i>V</i>	<i>A</i>	-									
<i>11</i>	<i>V</i>	-										
<i>12</i>	-											

Reachability Matrix

The SSIM layout was turned into the reachability matrix layout as in Table 2 by transforming each entry of the SSIM into 1's and 0's in the reachability matrix, as per defined prerequisites.

The rules for conversion of 0's and 1's are:

- The reachability matrix's (i, j) item will be 1 and the (j, i) item will be 0 if the (i, j) item in the SSIM is a V.
- The reachability matrix's (i, j) item will be 0 and the (j, i) item will be 1 if the (i, j) item in the SSIM is an A.
- Both the (i, j) and (j, i) items of the reachability matrix will be 1 if the (i, j) item in the SSIM is an X.
- The reachability matrix's (i, j) and (j, i) items will both be 0 if the SSIM's (i, j) value is a 0.

Table 2: Reachability Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	Driving Power
1	1	0	0	1	1	0	0	0	0	0	0	1	4
2	0	1	1	1	1	0	0	0	0	1	0	1	6
3	1	0	1	1	1	0	0	0	0	0	0	1	5
4	1	0	1	1	1	0	0	0	0	0	0	0	3
5	0	0	0	0	1	0	0	0	0	0	0	0	1
6	0	0	0	0	0	1	0	0	0	1	1	1	4
7	1	1	0	0	1	1	1	1	1	1	1	1	11
8	1	1	1	1	1	1	0	1	0	0	0	0	7
9	0	0	1	1	1	0	0	1	1	0	0	0	4
10	0	0	0	0	0	0	0	1	0	1	0	1	3
11	1	1	1	0	1	0	0	1	1	1	1	1	9
12	0	0	0	0	1	0	0	0	0	0	0	1	2
Dependence	6	4	5	6	10	3	1	5	4	5	3	8	

As indicated in Table 2, the SSIM values acquired in the preceding phase are converted to produce the reachability matrix, a binary matrix. Transitivity was incorporated in reachability matrix. It says that an element is indirectly

connected to C if it is linked to B and hence, B is linked to C. The ‘Dependence’ and ‘Driving Power’ are also determined. Dependence is known as the sum of columns and driving power is the sum of Rows.

Iteration Table

Table 3: Iteration Table

Factors	Factors	Reachability Set	Antecedent Set	Interaction Set	Level
1	<i>Perceived Ease of Use</i>	1,4,5,12	1,3,4,7,8,11	1,4	III
2	<i>Perceived risk</i>	2,3,4,10,12	2,7,8,11	2	II
3	<i>Perceived Usefulness</i>	1,3,4,5,12	2,3,7,8,11	3	III
4	<i>Social influence</i>	1,4,5	1,2,3,4,8,9	1,4	III
5	<i>User experience</i>	5	1,2,3,4,5,7,8,11,12,9	5	I
6	<i>Government/Regulatory support</i>	6,10,11,12	6,7,8	6	III
7	<i>Innovation</i>	1,2,3,5,6,7,8,9,10,11	7	7	III
8	<i>Continuous Digitalization</i>	1,2,3,4,5,6,8	7,8,9,10,11	8	III
9	<i>ICT Awareness</i>	4,8,9	5,7,9,11	9	III
10	<i>Security</i>	8,10,12	2,6,7,10,11	10	II
11	<i>Transparency</i>	1,2,3,5,8,9,10,11,12	6,7,11	11	III
12	<i>Trust</i>	5,12	1,2,3,6,7,10,11,12	12	III

Formation of ISM Based Model

The ISM Model is divided into the following three levels, as exhibited in Fig. 1:

Level I (Top Level): The Following factor is noticed at Level-1, which defines the top level in the hierarchy:

- User experience

Level II (Middle Level): The Following factors are identified at Level-II, which defines the middle level in the hierarchy:

- Security
- Government/ Regulatory Support

- Perceived Risk

Level III (Bottom Level): The Following factors are identified at Level-III, which defines the middle level in the hierarchy:

- Perceived ease of use
- Perceived usefulness
- Social influence
- Innovation
- Continuous Digitalisation
- ICT awareness
- Transparency
- Trust

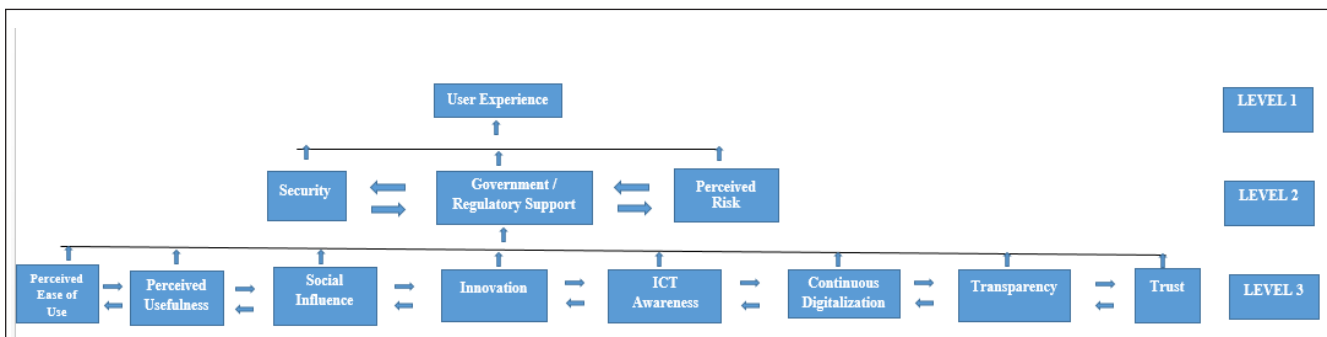


Fig. 1: Interpretive Structural Model w.r.t. Adoption of Digital Wallets

Interpretation of an ISM Based Model

The first and foremost factor 'User experience' is identified as the significant factor (Level-1) which influences the adoption of digital wallets. Furthermore, security, government/regulatory support and perceived risk are recognised as moderate significant factors (Level-2). Also, other factors (at Level-3) are identified as less significant factors which influence the adoption of digital wallets- perceived ease of use, perceived usefulness, social influence, innovation, ICT Awareness, continuous digitalisation, transparency, and trust. This implies that although all influencing factors are interdependent, but user experience being the highlighted factor to impact the intention to adopt digital wallets, and other factors are secondary factors.

MIC-MAC ANALYSIS

MIC-MAC analysis denotes an understanding of the forces that propel and rely on each identified factor in the ISM model. D. K. Dewangan et al. (2015). The variables are framed into four clusters: autonomous, dependent, linkage, and independent dimensions (Fig. 2).

- *Autonomous:* This quadrant does not have much influence on the model. It exhibits that not a single identified factors have weak dependence and driving powers indicating that all the variables are relatively linked to each other. In this study, autonomous factors ascertained are perceived risk, perceived ease of use, social influence, perceived usefulness, ICT awareness, trust, security and, government or regulatory support.
- *Dependent:* Weak 'driving power' and strong 'dependence power' is signified by this quadrant. Dependent factors ascertained are user experience and innovation.
- *Linkage:* Factors have both strong 'driving and dependence powers'. Linkage factors ascertained are nil.
- *Independent:* Factors have strong 'driving power' and weak 'dependence power'. Factors identified are dominant, i.e., with high driving power among them. Independent factors ascertained are continuous digitalisation and transparency.

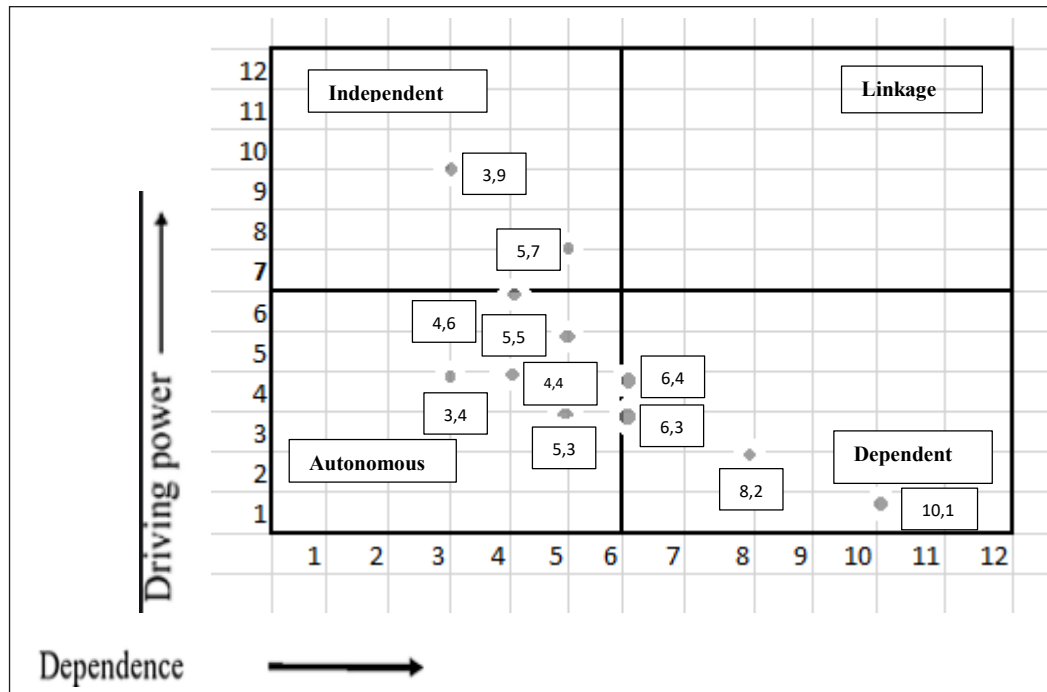


Fig. 2: MIC-MAC Analysis

LIMITATIONS OF THE STUDY

An issue or problem has numerous components. The complexity of an issue or problem grows as its aspects do, making the ISM methodology more challenging. Thus, take into account a small number of components when developing the ISM model. It is possible that certain components that have the least impact on an issue won't be included while building the ISM model. Furthermore, based on what we know, it is possible to know the components of an issue's driving and dependent forces. A prerequisite for MIC-MAC analysis is the ISM model.

RESULTS AND DISCUSSION

In general, user experience is one of the major critical success factor for a mobile user to use e-wallets (at Level 1). A wallet is an advantageous purpose-assembled payment product that adopts 'customer ownership.' The payment method is designed by the wallet to substitute and streamline the online transaction experience.

Furthermore, security, support from the government and regulatory bodies, and perceived risk are considered to be moderately significant variables (Level 2). Some elements are acknowledged as having less influence (at Level 3), such as perceived ease of use, social influence, perceived usefulness, innovation, ICT awareness, digitalisation, transparency, and trust. This exhibits that although all of

the influencing elements are interrelated, the key driver of intention to adopt digital wallets is the user experience, with the other factors acting as enablers.

Wallets are a step quicker for customers, a true touch-point to buyers. They provide a convenient experience and desired features to merchants and buyers (Seldal & Nyhus, 2022).

E-wallets connect national and international intermediaries, customers, and merchants at a common platform for carrying out transactions at just one-tap checkout with a confirmation (Patil et al., 2017). With the benefit of additional characteristics of e-wallets, users become convenient and habitual of using them with ease.

FUTURE SCOPE

It is crucial to comprehend the factors influencing Delhi's youth's adoption of digital wallets as we traverse the quickly changing world of digital payments. Key areas of focus in this context include a thorough investigation of influencing factors, utilising sophisticated analytical models, and strategic considerations for the adoption trajectory of digital wallets in the future.

- *User Experience Focus:* Future developments and implementations should place a high priority on improving the user experience, as it has been determined that this factor has the greatest impact on the adoption of digital wallets (Jia & Zulkipli, 2023).

- This could include features that are easy to use, transactions that go smoothly, and user-friendly interfaces.
- *Strengthening Security*: Although user experience is critical, digital wallet platforms should also have strong security measures. To reduce perceived risks and boost user confidence, security feature improvements should be ongoing activities (Meena & Sarabhai, 2023).
- *Regulatory Support*: The environment surrounding digital payments is greatly influenced by governmental and regulatory organisations (Bublyk et al., 2023). In order to ensure consumer protection and security, policies and laws should be developed to promote a favourable environment for the adoption of digital wallets.
- *Factors of the Technology Acceptance Model (TAM)*: Digital wallet providers should incorporate TAM factors, namely, ‘perceived risk’, ‘perceived usefulness’, ‘perceived ease of use’, and ‘social impact’, into their design and marketing efforts. User intention and adoption can be positively impacted by appropriately addressing these aspects.
- *Other Influencing Factors*: It’s important to take into account variables that are not related to the TAM, like innovation, ongoing digitalisation, ICT awareness, transparency, and trust. These elements can affect adoption patterns and are part of the larger ecosystem that digital wallets function in.
- *MIC-MAC Analysis and ISM Model Integration*: The Matrice d’Impacts Croisés-Multiplication Appliquée à un Classement (MIC-MAC) study and the Interpretive Structural Modelling (ISM) model can shed light on the interactions and effects of different influencing elements. These analytical methods should be used in future studies and projects to comprehend the intricate dynamics of digital wallet uptake.
- *Targeting Delhi Youths*: Customising digital wallet solutions and marketing strategies requires an understanding of the unique demands, tastes, and habits of Delhi youth (Rachna & Singh, 2013). Targeted surveys, focus groups, and usability studies can yield important information on their adoption preferences and behaviours.
- *Constant Improvement and Adaptation*: As technology advances and customer expectations change, the digital payments ecosystem is dynamic (Aurazo & Vega, 2021). To remain relevant, digital wallet companies should embrace a constant improvement and adaptation approach (Patil et al., 2017).

Hence, the financial environment is about to experiencing an unprecedented shift with the adoption of digital wallets,

which brings a host of advantages to both individual users and larger economic sectors (Jia & Zulkipli, 2023). Digital wallets are leading this revolution due to their exceptional user-friendliness (Castronova & Fairfield, 2014). With solely a few smartphone touches, people can easily manage their funds thanks to user-friendly interfaces and optimised procedures.

Digital wallets are really about accessibility, which is not limited by time or place (Animashaun, 2022). In contrast to conventional banking systems that frequently necessitate physical presence and strict operational hours, digital wallets are always open and allow transactions from any location with an internet connection, at any time. In addition to promoting ease, this widespread accessibility lessens reliance on physical money, opening the door for a society that is increasingly cashless (Lenniawati & Anastasia, 2020). Additionally, digital wallets offer previously unheard-of levels of convenience while revolutionising the speed and efficiency of transactions (Patel, 2023).

The growing use of digital wallets has significant consequences for financial inclusion that go beyond simple convenience (Joshi et al., 2019; Narang, 2021). Digital wallets act as accelerators for socioeconomic empowerment by giving the unbanked and underbanked a means of accessing formal financial services (Ebimoghan, 2020). Digital wallets remove traditional obstacles to financial access with its novel features, which include peer-to-peer transfers, microloans, and mobile payments (Jameaba, 2020). These features offer up a world of opportunity for people who were previously shut out of the formal banking system.

“How can a world be good in which money is the moving power, and self-interest the guiding star”.

H. Rider Haggaro

With this quote, the importance of digital wallets is better understood in terms of judging the ease of use with balanced perceived risk adopted by users. User experience is of utmost significant factor (Luther et al., 2020).

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A COMPARATIVE INVESTIGATION OF FRAUD DETECTION MODELS IN THE COFFEE INDUSTRY: A CASE STUDY OF LUCKIN COFFEE AND ITS COMPETITORS

Ankur Mittal*

Abstract *This research paper explores the efficacy of financial distress detection models, focusing on the Altman Z-Score, Ohlson O-Score, and Beneish M-Score metrics as a fraud detection tools in detecting corporate financial fraud, using Luckin Coffee Incorporation as a case study. The study highlights the superior predictability tools at initial stages for a firm indulging in fraudulent practices, shedding light on the complexities of financial misrepresentation in the corporate landscape. By providing a comparative analysis of Luckin Coffee with its competitors, namely Starbucks Corporation and McDonald's Corporation for 5 years from 2018 to 2022, the research aims to enhance transparency and accountability within corporate finance. The findings of this study highlight that Z-Score and M-Score are perfect tools for fraud detection, whereas O-Score gives contradictory result and this research is expected to assist researchers, auditors, and investors in identifying and mitigating financial fraudulent activities, thereby strengthening investor confidence in the market, and safeguarding against potential bankruptcy risks associated with misleading financial reporting practices.*

Keywords: *China Coffee Industry, Financial Irregularity, Fraud Detection Tools, Luckin Coffee*

INTRODUCTION

With the advent to international alliances and trade, an extensive variety of drinks have freshly entered the Chinese market in last decade. Young customer groups' eating behaviours and consuming behaviours are slightly influenced by various food backgrounds. Currently, coffee is China's second-most popular beverage. As per Yang Xuyao (2021), people in China are sipping more coffee daily, and the market is filled with cafes that have fantastic locations for people to relax and have fun. Several coffee companies have quickly expanded in the Chinese coffee marketplace because of the country's substantial coffee market and mounting consumer recognition.

According to Hou Weisheng's (2022) "China Coffee Machine Market Development Overview", the normal coffee intake in Europe and the United States is 365 cups per year per person. Yet, the average yearly consumption in China is less than 10 cups per person. China has a substantially higher marketplace ability for coffee growth than either Europe or America because it has the largest population in the world. The taste of coffee beverages also grows more contrasted

because of the various flavours of numerous coffee beans and the various processes of manufacturing coffee drinks.

Therefore, most people are likely to become potential consumers of coffee drinks. The International Coffee Organisation assessments shows that the Chinese coffee marketplace will be more than five trillion yuan in size in 2030, nearly five times the size of the American marketplace.

The Chinese market place does provide excellent potential for the coffee sector, which has flourished to become a popular investment point for Chinese investors. As per Tianyan Research, there were nearly 31 investment and financing events in China's coffee industry in 2021, with the total financing amount exceeding 18 billion yuan.

For a long time, Starbucks and McDonalds had almost the entire coffee market in China. However, this situation has been disrupted by the emergence of a local coffee brand named "Luckin", which has given Starbucks and McDonalds a powerful rival in the Chinese market. In less than three years, Luckin has more stores in China than Starbucks & McDonalds and is almost as well-known as Starbucks & McDonalds. The market positioning and marketing strategy

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behind Luckin’s compared with Starbucks and McDonalds in such a short period of time has raised new expectations from Luckin. The size and presence of Luckin Coffee initially gained attention for its innovative business model, which heavily focused on online ordering, delivery, and cashless transactions. It positioned itself as a tech-driven coffee chain, aiming to provide convenience to customers through its mobile apps. Starbucks & McDonalds, on the other hand, has a more traditional approach with a focus on in-store experiences.

Luckin Coffee was established in October 2017. From the time of its creation to its IPO, Luckin Coffee took just 20 months way into the Chinese market and quickly increased its reach thanks to its innovative marketing strategies and business style. As a new organisation, Luckin Coffee instantly developed its brand and grabbed the market share. It was not straightforward for it to achieve such excellent success as a home Chinese organisation. Consequently, how Luckin Coffee has succeeded with such great success and failure deserves further findings.

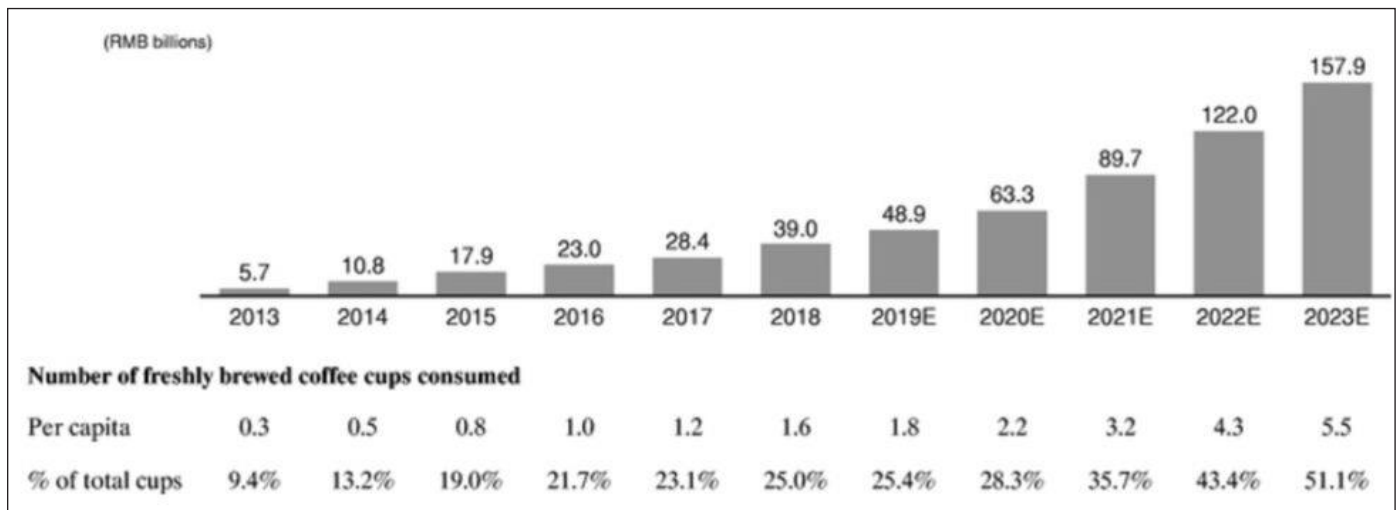
HISTORY OF LUCKIN COMPANY

Luckin Coffee Incorporation, a prominent player in China’s coffee retail industry, has emerged as a major competitor to Starbucks since its establishment in 2017. By March 2018, the company boasted an extensive network of 2,370 stores

across 28 cities in China. Despite its rapid expansion, Luckin faced financial challenges, reporting a substantial loss of \$482 million in 2018 despite generating \$840.7 million in revenue. Nevertheless, investors showed confidence in the company, leading to its successful listing on NASDAQ in 2019 with a remarkable 47% increase in stock value on debut.

However, Luckin’s success story was short-lived, as it soon became embroiled in a major scandal. The Security Exchange Commission (SEC) uncovered evidence indicating that Luckin had intentionally inflated its sales figures by over \$300 million through fraudulent schemes between April 2019 and January 2020. Additionally, the company’s employees exaggerated expenses by \$190 million to conceal the fabricated sales. The extent of the fraud became evident when it was revealed that Luckin had overstated its revenue and expenses by significant margins in the second and third quarters of 2019, leading to a substantial understatement of net losses.

Despite the fraudulent activities, Luckin managed to raise over \$864 million from investors within a short period, resulting in a staggering 200% increase in its stock price within eight months of listing. However, the SEC imposed a penalty of \$180 million on Luckin for deceiving investors with false financial statements. Consequently, Luckin was delisted from NASDAQ in 2020 and filed for bankruptcy (Fig. 1).



Source: Luckin Coffee report.

Fig. 1: Market Share of Coffee Sales in China

The board of directors are guilty for managing Luckin’s management and identifying immoral practices. Luckin’s former COO, Jian Liu, left in April 2020, confessing that he had inflated the company’s revenue. A few boards members and the chairman were changed after a general meeting which was held in July 2020.

The Luckin Coffee scandal serves as a stark reminder of the perils of unchecked ambition and the importance of ethical business practices. For investors, it underscores the need for due diligence. For businesses, it highlights the significance of trust, transparency, and integrity.

BUSINESS PROBLEM

As per Zhang, Yao (2022), from 2010 to 2018, there are 1,149 reported cases of corporate renaming from 665 unique firms across 18 industries in the Chinese share market. The frequency and irregularity of corporate renaming have aroused the attention of regulatory authorities. On September 30, 2016, the Shanghai Stock Exchange issued “Guidance of Listed Companies Changing Security Name,” which requires that listed companies have clear and business-relevant names and prohibits such companies from changing their names to mislead investors. In China, MIS stated the financial reports also increased in 2016, where financial reporting became unhealthy from both investors and regulators perspective.

Accounting frauds are now also not uncommon in the Chinese industry, especially when investors burn their hands with their hard earn money. It is therefore imperative to highlight the effective use of forensic tools to detect fraudulent activities of the companies that would help various stakeholders to be cautious at the right time.

The Accounting Scandal and Fraud at Luckin Coffee, made its financial statements fraudulent and fabricated to attract investors. Luckin has also been unsuccessful to reveal accurate revenue and expenses in 2018 and 2019 and obtained money through fabricated bank statements.

LITERATURE REVIEW

Financial fraud encompasses the conscious use of illicit methods to achieve financial gains (Kapoor, 2011). It not only impacts the financial sector but also extends its repercussions to broader facets of business and everyday life. Disclosures of fraudulent activities often lead to diminished investor confidence, thereby affecting the firm’s value and potentially leading to bankruptcy (PricewaterhouseCoopers, 2011). Furthermore, firms experience reputational damage and a loss of trust within the industry (Agarwal & Patni 2019). With advancements in technology and the rise of the internet and mobile computing, instances of fraud have surged in recent times (Yeh & Lien, 2009). This evolution in fraudulent practices necessitates corresponding adaptations in detection methods (Bhattacharyya et al., 2011), as traditional auditing approaches struggle to contend with increasingly sophisticated fraud cases.

Various theories attempt to explain the mechanisms and motivations behind fraudulent behaviour. Among these, the Fraud Triangle Theory (FTT) and Fraud Diamond Theory (FDT) are prominent. FTT posits that fraud occurs when pressure, opportunity, and rationalisation converge (Abdullahi & Mansor, 2015), with financial pressure often

cited as the primary instigator (Albrecht et al., 2006). FDT extends this framework by incorporating the perpetrator’s capability into the equation (Wolfe & Hermanson 2004). It emphasises the role of skills or abilities alongside pressure, opportunity, and rationalisation in facilitating fraudulent acts.

Given the increasing prevalence of fraud, it becomes imperative to develop methods for predicting its occurrence. Traditional auditing practices may prove inadequate in this regard. Forensic tools such as Altman’s Z-score and Beneish’s M-score, if employed earlier, could have potentially forecasted fraudulent activities in companies like Enron as early as 1997 (Mahatma, 2015). The simultaneous use of Z-score and M-score has been shown to provide enhanced protection for stakeholders (McCarthy, 2017). Furthermore, studies have demonstrated the predictive capabilities of the Z-score model in anticipating bankruptcy in various companies (Apurva et al., 2019). Similarly, the M-score serves as a valuable tool in detecting earnings manipulation behaviours (Anh & Linh, 2016).

However, the efficacy of these tools can vary depending on the context and company under scrutiny. While the Z-score model has demonstrated reliability in predicting financial viability across various sectors (Mohammed, 2016; Crumbley et al., 2019), its effectiveness may be influenced by factors such as company size, leverage, and liquidity (Crumbley et al., 2019). Similarly, the M-score may not always accurately detect fraud, as evidenced by its limitations in certain cases such as Toshiba (Bhavani & Amponsah, 2017).

Singh Vijay (2024) mentioned that accounting information and financial reporting are crucial for the effectiveness of capital markets, efficient resource allocation, capital information, and economic development, which is again appropriate for true financial reporting. V. Appa Rao and Venkatesh Maddeni (2024) also mentioned in the paper that accounting environment is getting changed day by day, inculcating new advancements in the landscape for financial reporting.

Saha (2021), Now what is “bankruptcy?”, it is a legal proceeding involving a person or business that is unable to repay outstanding debts. There are various models to predict the bankruptcy risk though here in this study has been used the Altman Z-score (1995) revised model. In this research, 21 banks are considered as sample where all are listed in Dhaka stock exchange (DSE). Basically, from the findings of the study, it is quite interesting that the non-conventional banks are in a better position on average overall z-score performance during the time period of 2009 to 2016, and the findings suggest to take private commercial banks under strict supervision of the central bank of Bangladesh.

The Ohlson O-score for predicting bankruptcy is a multi-factor financial formula postulated in 1980 by Dr. James Ohlson of the New York University Stern Accounting Department as an alternative to the Altman Z-score for predicting financial distress. The Ohlson O-score is the result of a 9-factor linear combination of coefficient-weighted business ratios which are readily obtained or derived from the standard periodic financial disclosure statements provided by publicly traded corporations. Alam (2022), James Ohlson O-Score for Predicting Corporate Bankruptcy states two of the factors utilised are widely considered to be dummies as their value and thus their impact upon the formula typically is 0. When using an O-score to evaluate the probability of a company's failure, then the exp (O-score) is divided by $1 + \exp(\text{O-score})$.

Srinivas (2023) aims to assess the financial distress status of selected NIFTY 50 companies in the Indian Stock Market. Out of the 50 NIFTY companies, only those outside the finance industry were chosen for analysis. The researcher utilised the financial statements of these companies as secondary data for the period 2022–23. This research paper is descriptive and analytical in nature. The Altman Z-Score model was used by the researcher to measure the financial distress of the companies, revealing that out of the 39 selected companies, 9 are in a state of bankruptcy.

Research Gap from Literature Review

Companies made false statements and fabricated its financial performance to lure in investors. Companies failed to reveal accurate revenue, expenses, and got money through fabricated bank statements. Furthermore, companies failed to maintain sufficient internal accounting controls or keep precise financial records. The company understood its financial statement and records were misleading. In this research, it has done all fabrication of its financial statements and collaborated with funding companies, vendors, and third-party covering companies to fabricate expenses and costs leading investors to burn hands on their investment.

FRAUD DETECTION

It is the process of identifying fraudulent activities or attempts. It is crucial to have an uncovering system in place to avoid fraud from happening and to safeguard businesses and consumers from the financial losses that can develop from this behaviour. Fraud detection is the procedure of identifying whether a transaction is fraudulent or not. This can be done through numerous methods, such as analysing client behaviour or looking for financial designs in the data that might denote deceptive cases.

There are various ways to avoid fraud, such as using data analytics to identify risk factors, establishing up detection systems, or guiding the workforce to be on the lookout for indicators of fraudulent blueprints. By taking protective steps, businesses can guard themselves from financial losses and harm to their reputation.

Notwithstanding, numerous techniques are available to detect fraud, such as data mining, machine learning, artificial intelligence, neural networks, ratio analysis, and so on. In this study, various financial statement fraud detection models are discussed as they help investors and regulators to detect fraudulent activities from the information provided in an entity's financial statement.

Tools for Fraud Detection

Data mining is a process of extracting patterns from data. It can be used to identify fraud by observing uncommon patterns in data that may be investigative of scam. The models found in data extracting can be used to create extrapolative models that can be used for future finding, too. When data mining for fraud, common data sets are analysed using financial data for at least 5 years.

This paper assesses the applicability of X-Score, Y-Score, and Z-Score models in measuring the financial performance of listed companies. The study suggests that using fraudulent tools can predict the future potential of the company with analysing the financial health of the company to safeguard investors to exit from the respective companies.

A COMPREHENSIVE EXPLANATION ON THE TOOLS USED IN THIS RESEARCH

Altman Prediction Technique (Z-Score)

The Altman Z-Score technique, developed by NYU Stern Professor Edward Altman in 1968, is a multivariate bankruptcy prediction model that categorises firms into three zones of discrimination based on their Z-Score values. According to the model, firms with a Z-Score greater than 2.67 are considered solvent, those with a Z-Score below 1.81 are deemed to be in distress, and firms with Z-Scores falling between 1.81 and 2.67 are placed in the "grey zone."

This method utilises accounting variable star and encompasses five ratios representing liquidity, solvency, profitability, leverage, and asset turnover. The formula for calculating the Altman Z-Score is as follows:

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.999X_5$$

Where:

X1 = Working Capital/Total Assets

X2 = Retained Earnings/Total Assets

X3 = EBIT/Total Assets

X4 = Book Value of Equity/Total Liabilities

X5 = Sales/Total Asset

The Altman Z-Score has garnered widespread acclaim for its accuracy in predicting financial distress, as noted by Altman et al. (2013). However, despite its effectiveness, there have been few criticisms levelled against it. One common critique suggests that a low Z-Score may signal an increased risk of financial statement fraud. Nevertheless, research by Tinoco and Wilson (2013), Altman et al. (2016), Halteh et al. (2018), and Indriyanti (2019) has indicated that even companies with low Z-Scores do not necessarily engage in fraudulent activities.

Altman (1970) himself acknowledged that the Z-Score is not a probabilistic tool but rather a descriptive-comparative one. It serves as a warning mechanism regarding the likelihood of impending financial distress rather than providing a definitive prediction of insolvency (Altman et al., 2013). Corporate failure typically unfolds over time, and firms with strong balance sheets rarely face immediate bankruptcy (Agarwal & Taffler, 2008, p. 1550).

Ohlson Prediction Technique (O-Score)

The Ohlson O-Score, introduced by Ohlson (1980), stands as a robust bankruptcy prediction method utilised to assess a company's financial robustness. Ohlson's logit approach incorporates nine distinct ratios and corresponding coefficient weighting to derive the comprehensive O-Score. This formula serves as a valuable tool in evaluating the financial health and potential distress of a firm:

$$Y = -1.3 - 0.4Y1 + 6.0Y2 - 1.4Y3 + 0.8Y4 - 2.4Y5 - 1.8Y6 + 0.3Y7 - 1.7Y8 - 0.5Y9$$

Y = overall index:

Y1 = log (total assets/GNP Price-level index)

Y2 = total liabilities/total assets

Y3 = working capital/total assets

Y4 = current liabilities/current assets

Y5 = one if total liabilities exceed total assets, zero otherwise

Y6 = net income/total assets

Y7 = funds provided by operations/total liabilities

Y8 = one if net income was negative for the last two years, zero otherwise

Y9 = change in net income

The Ohlson technique, rooted in liquidity, profitability, and solvency ratios, aligns with established literature on

bankruptcy prediction methodologies (Altman, 1968; Young & Coleman, 2009; Kumar & Kumar, 2012). Employing a logit approach, Ohlson's model assigns values within the range of 0 to 1, with a cut-off point of 0.5. Scores exceeding 0.5 indicate a higher probability of default, while scores below 0.5 suggest a reduced likelihood of default.

Despite its utility, the O-Score faces notable limitations. One challenge lies in the practical application, particularly regarding the availability of certain data points such as the GNP price-level index for computing the Y1 ratio (Xu & Zhang, 2009; Lawrence et al., 2015; Indriyanti, 2019; Tanjung, 2020). Critics also point out its failure to incorporate firm-level market transaction data and its static parameter framework, which overlooks changes in financial dynamics over time (Begley et al., 1996; Hillegeist et al., 2004; Agarwal & Taffler, 2008; Hensher & Jones, 2007). Consequently, the O-Score may not fully capture evolving financial circumstances and behavioural patterns within companies.

Beneish Prediction Technique (M-Score)

The Beneish M-Score, introduced by Beneish in 1997, serves as a mathematical tool to assess whether a company has engaged in financial statement manipulation. This technique utilises a set of financial ratios, consisting of either 5 or 8 variables, to scrutinise the likelihood of fraudulent activities in a company's financial reports (Beneish, 1997). Each variable is designed such that higher values correspond to an increased probability of manipulation (Beneish, Lee & Nichols, 2013). Similar to the Z-Score, the M-Score is employed primarily to detect earnings manipulation in financial reports. The formulae for calculating the M-Score are as follows:

M 5 Score –Variable Technique

$$M = -6.065 + .823 DSRI + .906 GMI + .593 AQI + .717 SGI + .107 DEPI$$

M 8 Score –Variable Technique

$$M = -4.84 + 0.92 DSRI + 0.528 GMI + 0.404 AQI + 0.892 SGI + 0.115 DEPI - 0.172 SGAI + 4.679 TATA - 0.327 LVGI$$

Where:

DSRI - Days' sales in receivable index

GMI - Gross margin index

AQI - Asset quality index

SGI - Sales growth index

DEPI - Depreciation index

SGAI - Sales and general and administrative expenses index

LVGI - Leverage index

TATA - Total accruals to total assets

Once computed, the results from the eight variables are amalgamated to formulate the M-Score. Recent updates by Beneish et al. (2013) have revised the threshold for interpretation, where a score lower than -1.78 (formerly -2.22) suggests the absence of earnings manipulation, while a score higher than -1.78 (formerly -2.22) indicates potential manipulation of financial statements (Beneish, 1999a).

The Beneish M-Score has garnered widespread usage and demonstrated accuracy in various studies (Beneish, 1999b; Rosner, 2003; Beneish & Nichols, 2007; Roxas, 2011; Fazli, Mohamed & Rahmat, 2016; Alfian & Triani, 2019). Reviews of the technique have consistently shown its efficacy in detecting earnings management and fraudulent financial statements (Beneish et al., 2013; Mahama, 2015). Employed as a tool to identify earnings manipulation and evaluate the quality of financial statements, the Beneish M-Score has proven effective in selected case studies (Chadha, 2014; Fridson, 2002; Alfian & Triani).

Notwithstanding its accuracy in estimating the possibility of manipulation, the Beneish M-Score has faced disapproval for its failure to identify deteriorating basics and forceful accounting practices (Mehta & Bhavani, 2017; Alfian & Triani, 2019). In some studies, it is suggested that the tool may only flag problematical areas already reviewed by auditors (Harrington, 2005), while others argue that the 8-variable version is less effective in predicting risks (Ugochukwu, Okoye & Azubuike, 2013). Operationalisation challenges and metric definition complexities have also been noted as drawbacks (Amoa-Gyarteng, 2014). However, the Beneish M-Score is a valuable tool for approximating the chances of earnings misuse in financial reports (Beneish & Nichols, 2005; Beneish et al., 2013).

RESEARCH METHODOLOGY

As per the Deloitte (2008), there is a connection between bankruptcy and fraud, and there is a high chance that a

company on the verge of bankruptcy would engage in fraudulent activities or manipulate the financial statement. This implies that, prior to the collapse of the company, there was pressure on the management team to manipulate earnings to show a better picture for the shareholders. This implies that at the verge of bankruptcy, managers are motivated to manipulate their financial statements to show a better financial picture to the stakeholders. This creates a linkage between a distressed company and a fraudulent company, hence Overall, the utilisation of forensic tools which evaluates liquidity, profitability, and solvency of the organisation uses important metrics like the Z-score, O-Score, and M-score, to offer valuable insights into the financial health and integrity of companies for the investors to invest in these types of companies. However, their application should be accompanied by a thorough understanding of their limitations and contextual factors to ensure effective fraud detection and prevention strategies.

In this paper, we delve into the intriguing the realm of financial forensics tools, scrutinising the accuracy and efficacy of forensic metrics such as the Z-score, O-score, and M-score. Our focal point is Luckin Coffee Incorporation, a company embroiled in controversy, and its financial statements, which we compare meticulously with industry giants McDonald’s and Starbucks as it already operates in Chinese market as leader in coffee. The objective is to forecast fraud from the perspective of stakeholders, shedding light on financial metrics and corporate misdeeds. Through meticulous data gathering and comprehensive analysis, we aim to offer insights that transcend not mere numbers but provide a compelling narrative of applied methods in the realm of corporate finance. Data for Lukin, Starbucks & McDonald have been collected from its annual reports for 5 years, from 2018 to 2022. A theoretical framework in Fig. 2 gives the glimpse of how the comparative analysis has been done from the financial statements.

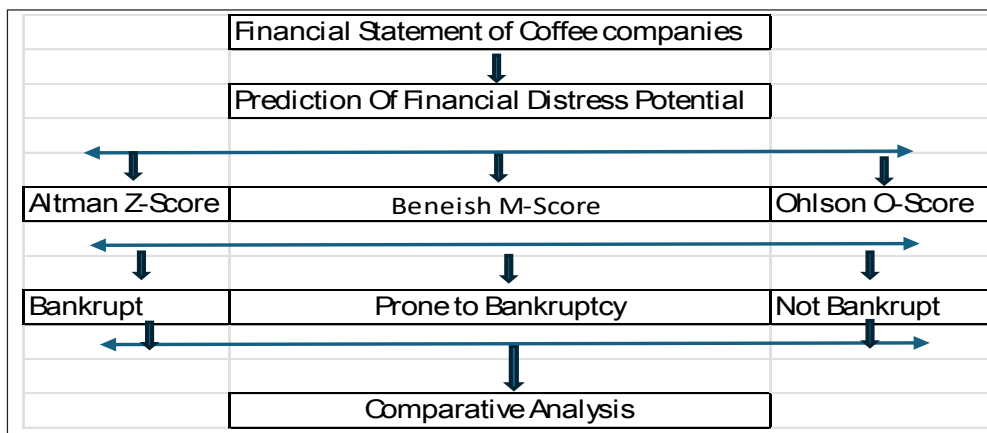


Fig. 2: Theoretical Framework by the Author

DATA SOURCE

Embarking on our journey of financial analysis, we meticulously sourced data from the annual financial reports of Luckin Coffee and its competitors. Recognising the importance of industry trends, we deemed it essential to conduct a comparative analysis, unravelling the intricate patterns woven within the fabric of their financial performance. The tools used are the comprehensive array of financial metrics housed within the company’s income statements, balance sheets, and accompanying notes. These invaluable resources provided the raw data necessary for our calculations, enabling us to assess liquidity, profitability, efficiency, and solvency.

The case of Luckin’s accounting fraud highlights the pressing need for effective forensic tools. This paper aims to assess the applicability and effectiveness of forensic tools such as the Altman Z-Score, Olson O-Score, and Beneish M-Score in detecting financial irregularities. Comparative statement analysis of Luckin and its peers will also be conducted to enhance the accuracy of predicting fraudulent activities.

With precision and rigour, we collated this wealth of financial data into an Excel spreadsheet, laying the foundation for our analytical journey. Through detailed calculation, we have used established forensic tools such as the Altman Z-Score, Ohlson O-Score, and the Beneish M-Score. Armed with these powerful instruments, we embarked on a sail of discovery, uncovering insights that surpass mere numbers, illuminating the path towards a deeper understanding of corporate financial health.

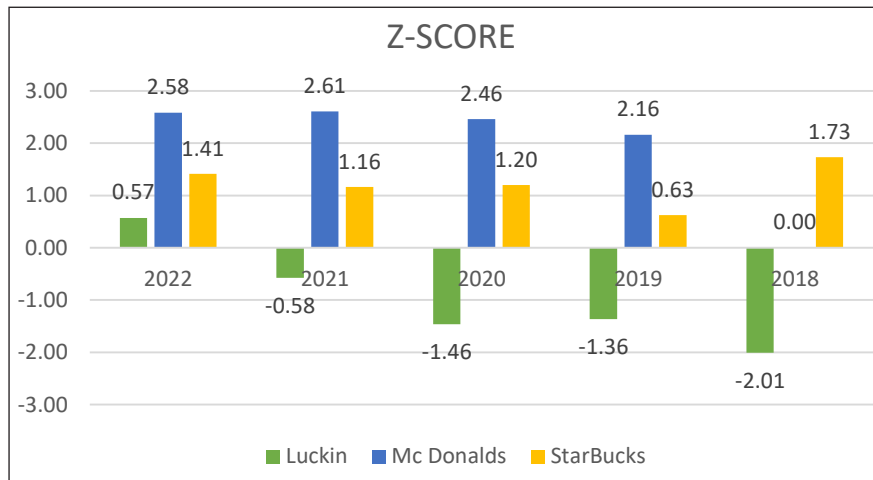
DATA ANALYSIS AND FINDINGS (ANNEXES J)

Altman’s Z-Score Analysis

The exceptionally lower Z-Score of -2.01 for Luckin Coffee in 2018, significantly surpassing the benchmark of below -1.81, raises red flags regarding potential financial manipulation. This suspicion was further validated by a Security Exchange Commission (SEC) report, which unveiled that Luckin overstated its reported revenue by approximately 28% for the second quarter of 2019 and by a staggering 45% for the third quarter. Concurrently, the company understated its net loss by approximately 15% and 34% for the same periods.

The fabrication of transactions commenced in April 2019, resulting in Luckin inflating its net revenue by \$328 million for the year. This substantial manipulation manifested in a remarkable -1.36 score in 2019. However, in 2020, an internal investigation into the fabricated sales uncovered the true Z-Score for Luckin as -1.46, indicative of a company in a state of distress. Comparatively, Luckin’s competitors, namely McDonalds & Starbucks maintained adequate Z-Scores, averaging around 1.73 to 2.58, signifying their solvency and stability. The Luckin’s Z-Score of 0-.58 from 2021 to positive .57 in 2022 is also indicating that the company is improving its financial position.

Validity: From these findings, it is reasonable to suspect that the fabrication of sales figures in Luckin Coffee’s earnings reports stemmed from poor management of its partnerships and an intent to manipulate financial statements to mislead stakeholders (Fig. 3).



Source: Authors own calculation.

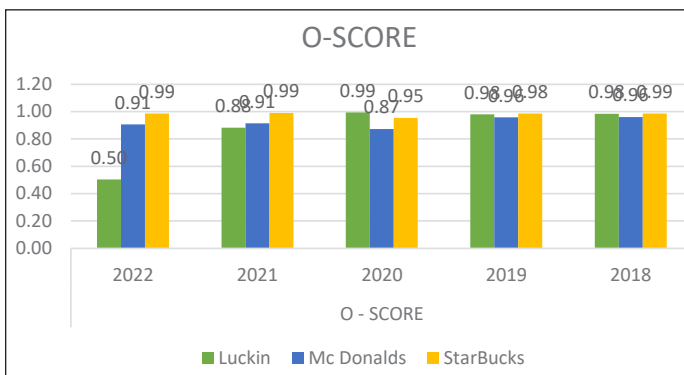
Fig. 3: Altman’s Z-Score

Ohlson’s O-Score Analysis (Annexes J)

The Ohlson O-Score is a pivotal metric utilised to gauge financial distress, leveraging a range of parameters to assess a company’s fiscal health. However, one crucial parameter, the logarithm representing Y1 (total assets/GNP price-level index), is notably absent in established databases, rendering the computation of the O-Score unfeasible through conventional means. Nevertheless, an analysis of this ratio for Luckin Coffee spanning from 2018 to 2022 reveals a concerning trend. The ratio surged from 0.98 to 0.50 during this period, indicating a steep rise in the probability of default. However, in 2022, Fig. 4 shows the probability of .50, indicates it has less chance of default.

Comparatively, Luckin’s peers, Starbucks and McDonald’s, maintained an average O-Score of 0.98 during the same timeframe, which also depicts these companies having a higher chance of default. A deeper examination of Luckin’s financial statements reveals a concerning trajectory. Total liabilities surged from USD 165 million in 2018 to USD 1.124 billion in 2021, while net income consistently posted negative figures from 2018 to 2020.

Validity: The author is in the opinion that the O-score is not very effective, as the competitors of Luckin, have an average score of .95, which suggests a high chance of default, but these companies have not defaulted in the aforesaid period. Whereas Luckin O-score from 2018 was .98 which indicates a high chance of default, but it has been gradually decreasing to .5 in 2022, which is questionable for the efficacy of O-score.



Source: Authors own calculation.

Fig. 4: Ohlson’s O-Score

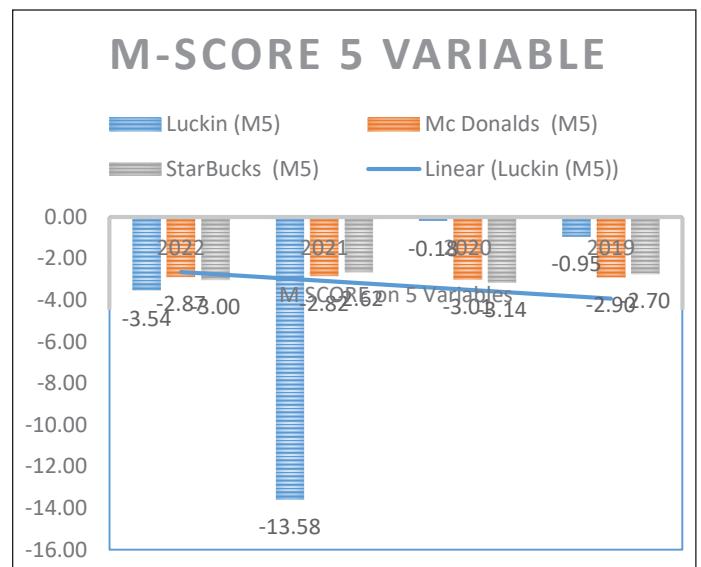
Beneish (M5) and (M8) Score Analysis (Annexes J)

Beneish’s research has shed light on a crucial threshold for detecting profit manipulation within companies. With a

threshold greater than -2.22 new indicating a potential for manipulation, this model stands out as a beacon of accuracy in identifying financial discrepancies. Indeed, amidst various interpretations, this model stands firm as a reliable indicator of profit manipulation.

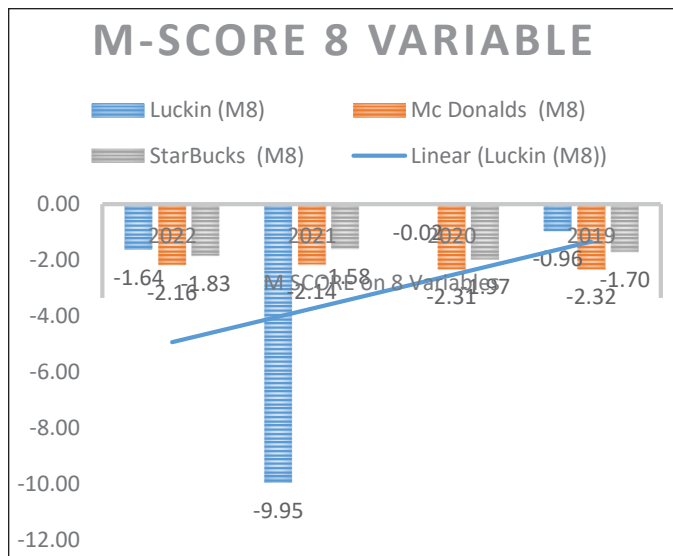
Figs. 5 and 6 vividly illustrate this concept, particularly when examining the M5 and M8 scores of peer companies Starbucks and McDonald’s. Both peers boast an average score of -2.0, well below the critical threshold, suggesting a lack of profit manipulation. Contrastingly, Luckin’s M5 and M8 scores for the year 2019 reveal positive values, signalling a concerning deviation from financial integrity and a strong indication of earnings manipulation. As the market reacted to these revelations and Luckin Coffee took strides towards bolstering corporate governance, the M-Scores for both M5 and M8 began to decline. By 2022, these scores had notably improved, reaching -3.54 for M5 and -1.64 for M8 from -9.95 for M5 and -13.58 for M8 in 2021 these developments mark a significant milestone for Luckin Coffee as it endeavors to restore normalised financial reporting.

Validity: Beneish score stands tall in terms of manipulating the financial records, which are proved in the above analysis; hence to conclude. Both B5 and B8 of McDonalds and Starbucks are within the range -2.00 which can be said they are not manipulators; however for Luckin, the said score on average is -3.44 from 2018 till 2022 and very high in 2021, which is -13.58 for M5 and -9.95 for M8, which validates the performance of Luckin with its competitors and delves into the financial stress model in its effectiveness.



Source: Authors own calculations.

Fig. 5: M-Score 5



Source: Authors own calculations.

Fig. 6: M-Score 8

IMPLICATIONS

The research provides practical insights for investors, auditors, regulators, and other stakeholders in using these fraud detection models effectively. By demonstrating their application in a real-world scenario like the Luckin Coffee case, this paper offers guidance on how to interpret the results of these models and take appropriate action. Also, we understand the implications of these fraud detection models for Luckin Coffee and its competitors could have broader implications for risk management within the industry. By identifying common risk factors associated with fraudulent activities, companies can implement better risk mitigation strategies.

The findings of the research inform policymakers and regulators about the effectiveness of existing fraud detection tools and the need for enhanced regulatory measures. This could lead to upgrading in corporate governance standards and regulatory administration to prevent future fraud episodes.

The paper also identifies gaps like Z-Score and M-Score, which are very effective and provided almost same result as opposed to O-Score which is contradictory in existing fraud detection methodologies and suggests areas for further research. This includes exploring the applicability of advanced machine learning techniques or incorporating non-financial indicators into fraud detection models.

DISCUSSION

The objective of this study was to identify an effective tool for detecting financial fraud within the company. Our analysis revealed that both the Z-Score and M-Score proved to be efficient and effective tools for uncovering fraudulent activities. However, it is important to note that the O-Score exhibited limitations, yielding results that were not as closely aligned with those obtained from the Z-Score and M-Score. This disparity may be attributed to the limited availability of data for these models, highlighting the need for further refinement and validation.

LIMITATIONS AND SCOPE FOR FURTHER STUDY

One significant limitation of this research stems from the limited duration of data available for analysis, as Luckin Coffee initiated fraudulent activities shortly after its listing on the stock exchanges. To facilitate more robust comparisons with other companies, the dataset was restricted to 5 years and 4 years effectively for the M-score analysis. Future research endeavors could benefit from an expanded dataset spanning a longer timeframe, thereby enhancing the scope and depth of the present study's findings. Additionally, exploring alternative methodologies and incorporating additional variables could offer further insights into the detection and prevention of financial fraud in corporate settings.

CONCLUSION

The study presented in this paper offers a comprehensive examination of the fraudulent financial practices observed in Luckin Coffee's financial statements, marking a significant contribution to the field. By employing various analytical measures, including the Altman Z-Score, Olson O-Score, and Beneish M-Score, a thorough analysis of the company's financial data was conducted, shedding light on the intricate nature of the fraudulent activities perpetrated by the company.

Moreover, this study stands as a pioneering effort in its domain, being among the first to delve into the depths of Luckin Coffee's financial misrepresentations. By juxtaposing the company's financial performance with that of its peers, valuable insights were gleaned, offering readers a nuanced understanding of the dynamics at play and the red flags indicative of potential window-dressing practices.

The findings underscore the likelihood that Luckin Coffee's inflated sales figures can be attributed to systemic issues

within the company, particularly in its management of external retail partners. The rapid expansion undertaken by Luckin Coffee during the latter part of 2019, marked by the opening of numerous stores across China daily, likely strained the company's operational capabilities and oversight mechanisms. This heightened pace of expansion may have contributed to a breakdown in management controls, thereby facilitating the perpetration of fraudulent activities.

Looking ahead, future research endeavours could delve deeper into the relationship between Luckin Coffee's introduction of new tea products and the fabrication of sales figures. Exploring potential correlations between these factors could provide invaluable insights into the underlying mechanisms driving financial misconduct within the company.

In summation, this study not only offers a retrospective analysis of Luckin Coffee's fraudulent practices but also lays the groundwork for future investigations aimed at unravelling the complexities of financial misrepresentation in the corporate landscape. By fostering a deeper understanding of the warning signs and implications of such misconduct, this research serves as a catalyst for enhanced transparency and accountability within the realm of corporate finance.

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APPENDIX (FINANCIAL DATA EXTRACTED FROM MONEYCONTROL.COM AND CALCULATION BY AUTHOR)

A: Luckin Z-Score

Fiscal year is January-December. All values USD Millions.	2022	2021	2020	2019	2018
Total Current Liabilities	2,828.84	6,591.63	1,000.99	4,309.38	780.89
Total Current Assets FOR CALCULATION PURPOSES ONLY	6,037.05	8,383.35	6,420.20	7,552.38	2,428.68
Total Liabilities	3,853.11	7,166.69	6,666.03	4,702.14	1,134.33
Retained Earnings	-11,385.49	-11,873.73	-12,452.28	-6,863.17	-3,246.70
Total Assets	10,480.40	12,312.49	9,322.40	9,762.26	3,485.08
EBIT	1,453.19	-178.13	-2,040.55	-3,212.11	-1,598.01
Sales/Revenue	13,292.98	7,965.32	4,033.42	3,024.93	840.7
Total Shareholders' Equity (Book Value)	10,480.40	12,312.49	9,322.40	9,762.26	3,485.08
Common shares outstanding	310.01	2,095.24	2,025.17	1,942.37	1,883.02
MARKET VALUE					
x1	0.306	0.146	0.581	0.332	0.473
x2	-1.086	-0.964	-1.336	-0.703	-0.932
x3	0.139	-0.014	-0.219	-0.329	-0.459
x4	0.000	0.000	0.000	0.000	0.000
x5	1.268	0.647	0.433	0.310	0.241
Z	0.571	-0.577	-1.463	-1.362	-2.009

B: Luckin Ohlson O-Score

Ohlson O-score Model						
		2022	2021	2020	2019	2018
	Inputs					
TA	total assets	10,480.40	12,312.49	9,322.40	9,762.26	3,485.08
GNP	Gross National Product price index level	100.00	100.00	100.00	100.00	100.00
TL	total liabilities	3,853.11	7,166.69	6,666.03	4,702.14	1,134.33
WC	working capital	3,208.21	1,791.72	5,419.21	3,243.00	1,647.79
CL	current liabilities	2,828.84	6,591.63	1,000.99	4,309.38	780.89
CA	current assets	6,037.05	8,383.35	6,420.20	7,552.38	2,428.68
X	1 if TL > TA, 0 otherwise	0.00	0.00	0.00	0.00	0.00
NI	net income	488.25	578.54	-5,589.10	-3,158.43	-1,619.15
NI_t-1	net income (t-1)	-0.99	1.02	4.19	2.93	3.12
FFO	funds from operations	19.82	123.45	-2,376.83	-2,166.97	-1,310.69
Y	1 if a net loss for the last two years, 0 otherwise	0.00	1.00	1.00	1.00	0.00
	Coefficients	values	values	values	values	values
		-1.32				
		-0.407	2.02	2.09	1.97	1.99
		6.03	0.37	0.58	0.72	0.48
		-1.43	0.53	0.21	0.84	0.43
		0.0757	0.27	0.54	0.11	0.44
		-1.72	0.00	0.00	0.00	0.00
		-2.37	0.05	0.05	-0.60	-0.32
		-1.83	0.01	0.02	-0.36	-0.46
		0.285	0.00	1.00	1.00	1.00
		-0.521	1.00	1.00	-1.00	-1.00
	T	0.01	2.02	5.19	3.93	4.12
	default probability	50.36%	88%	99%	98%	98%

G: StarBucks Z-Score

Fiscal year is January-December. All values USD Millions.		2022	2021	2020	2019	2018
Total Current Liabilities		9,345.30	9,151.80	8,151.40	7,346.80	6,168.70
Total Current Assets FOR CALCULATION PURPOSES ONLY		7,303.40	7,018.70	9,756.40	7,806.40	5,653.90
Total Liabilities		37,433.30	36,677.10	36,707.10	37,179.60	25,451.80
Retained Earnings		-7,255.80	-8,449.80	-6,315.70	-7,815.60	-5,771.20
Total Assets		29,445.50	27,978.40	31,392.60	29,374.50	19,219.60
EBIT		5,526.10	4444	4,701.60	1,599.90	4,700.70
Sales/Revenue		35,975.60	32,250.30	29,060.60	23,518	26,508.60
Total Shareholders' Equity (Book Value)		29,445.50	27,978.40	31,392.60	29,374.50	19,219.60
Common shares outstanding		1,142.60	1,147.90	1,180	1,173.30	1,184.60
MARKET VALUE						
	x1	-0.069	-0.076	0.051	0.016	-0.027
	x2	-0.246	-0.302	-0.201	-0.266	-0.300
	x3	0.188	0.159	0.150	0.054	0.245
	x4	0.000	0.000	0.000	0.000	0.000
	x5	1.222	1.153	0.926	0.801	1.379
	Z	1.412	1.161	1.199	0.626	1.732

H: StarBucks O-Score

		Ohlson O-score Model				
		2022	2021	2020	2019	2018
	Inputs					
TA	total assets	29,445.50	27,978.40	31,392.60	29,374.50	19,219.60
GNP	Gross National Product price index level	100.00	100.00	100.00	100.00	100.00
TL	total liabilities	37,433.30	36,677.10	36,707.10	37,179.60	25,451.80
WC	working capital	-2,041.90	-2,133.10	1,605.00	459.60	-514.80
CL	current liabilities	9,345.30	9,151.80	8,151.40	7,346.80	6,168.70
CA	current assets	7,303.40	7,018.70	9,756.40	7,806.40	5,653.90
X	1 if TL > TA, 0 otherwise	1.00	1.00	1.00	1.00	1.00
NI	net income	4,124.50	3,281.60	4,199.30	928.30	3,599.20
NI_t-1	net income (t-1)	3.24	3.63	2.03	3.17	3.19
FFO	funds from operations	5,526.10	4,444.00	4,701.60	1,599.90	4,700.70
Y	1 if a net loss for the last two years, 0 otherwise	0.00	0.00	0.00	0.00	0.00
	Coefficients	values	values	values	values	values
		-1.32				
		-0.407	2.47	2.45	2.50	2.47
		6.03	1.27	1.31	1.17	1.27
		-1.43	-0.28	-0.30	0.16	0.06
		0.0757	0.32	0.33	0.26	0.25
		-1.72	1.00	1.00	1.00	1.00
		-2.37	0.14	0.12	0.13	0.03
		-1.83	0.15	0.12	0.13	0.04
		0.285	0.00	0.00	0.00	0.00
		-0.521	1.00	1.00	1.00	0.99
	T	4.24	4.63	3.03	4.17	4.19
	default probability	98.58%		99%	95%	98%
						99%

I: StarBucks M-Score

Beneish M-Score											
Parameters Balance Sheet & Income statement						Notes and definitions					
Year	2022	2021	2020	2019	2018	5 variable equation	M = -6.065+ .823 DSR + .906 GM + .593 AQ + .717 SG + .107 D				
Net Sales	35976	32250	29061	23518	26509	8 variable equation	M = -4.84+ .920 DSR + .528 GM + .404 AQ + .892 SG + .115 D -.172 SGA + 4.679 TA - .327 L				
Cost of Goods	26106	23865	20625	18377	19021						
Net Receivables	1184	1176	940	883	879	SGA	Selling, General and Administrative Expenses				
Current Assets	7303	7019	9756	7806	5654	CA	Current Assets				
Property, Plant and Equipment	15800	14576	14606	14376	6432	DSR	Days Sales in Receivables				
Depreciation	1429	1337	1301	1280	1377	GM	Gross Margin				
Total Assets	29446	27978	31393	29375	19220	AQ	Asset Quality				
SGA Expense	2441	2032	1933	1680	1824	SG	Sales Growth				
Net Income	9869	8385	8435	5141	7488	D	Depreciation				
Cash Flow from Operations	5526	4444	4702	1600	4701	SGA	Sales, General and Administrative Expenses				
Current Liabilities	9345	9152	8151	7347	6169	L	Leverage				
Long-term Debt	13589	13154	13618	14660	11167	TA	Total Accruals to Total Assets				
Beneish Ratios						Year					
Other L/T Assets [TA-(CA+PPE)]	6342	6384	7031	7193	7134	M-score	2022	2021	2020	2019	2018
DSRI	0.903	1.127	0.861	1.133	#DIV/0!	5 variable model	-3.00	-2.62	-3.14	-2.70	#DIV/0!
GMI	0.948	1.116	0.753	1.292	#DIV/0!	8 variable model	-1.83	-1.58	-1.97	-1.70	#DIV/0!
AQI	0.944	1.019	0.915	0.660	#DIV/0!						
SGI	1.116	1.110	1.236	0.887	#DIV/0!						
D	1.013	0.973	0.999	2.158	#DIV/0!						
SGAI	1.077	0.947	0.931	1.038	#DIV/0!						
TATA	0.148	0.141	0.119	0.121	0.145						
L	0.977	1.150	0.926	0.831	#DIV/0!						

J: Overall Combined Sheet of All Metrics by Author

Z SCORE					
	2022	2021	2020	2019	2018
Luckin	0.57	-0.58	-1.46	-1.36	-2.01
McDonalds	2.58	2.61	2.46	2.16	0.00
StarBucks	1.41	1.16	1.20	0.63	1.73

O - SCORE					
	2022	2021	2020	2019	2018
Luckin	0.50	0.88	0.99	0.98	0.98
McDonalds	0.91	0.91	0.87	0.96	0.96
StarBucks	0.99	0.99	0.95	0.98	0.99

M SCORE on 5 Variables				
	2022	2021	2020	2019
Luckin (M5)	-3.54	-13.58	-0.18	-0.95
McDonalds (M5)	-2.87	-2.82	-3.01	-2.90
StarBucks (M5)	-3.00	-2.62	-3.14	-2.70

M SCORE on 8 Variables				
	2022	2021	2020	2019
Luckin (M8)	-1.64	-9.95	-0.02	-0.96
McDonalds (M8)	-2.16	-2.14	-2.31	-2.32
StarBucks (M8)	-1.83	-1.58	-1.97	-1.70