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Time in the Market vs. Timing the Market: Empirical Evidence on the Efficacy of Passive SIPs over Tactical Overlays - MD Aaquib Dilkash, Pankaj Kumar Gupta

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Abstract

This study investigates whether tactical market timing improves the performance of systematic investment plans. Using a 218-month sample of the Nifty 50 Total Return Index from March 2008 to April 2026, we test a contrarian strategy that diverts periodic equity allocations into a risk-free asset yielding 6 per cent during market uptrends. This capital is hoarded as cash and subsequently deployed in concentrated tranches during market drawdowns. Although the dynamic strategy mechanically identifies market peaks and successfully withholds capital in 65.1 per cent of the observation periods, it fails to outperform an unconditional buy-and-hold systematic investment plan. The tactical overlay compresses annualized volatility by 58 basis points (dropping from 19.93 per cent to 19.35 per cent) but generates a statistically indistinguishable Internal Rate of Return (10.86 per cent versus 10.89 per cent). Non-parametric Wilcoxon signed-rank tests confirm the distribution of time-weighted returns is not significantly different ($p = 0.3949$). The results demonstrate that the opportunity cost of holding cash during bull markets entirely offsets the mathematical advantage of concentrated dip-buying during corrections. We conclude that applying technical overlays to periodic cash flows does not generate excess alpha or significantly alter terminal wealth, providing robust empirical support for uninterrupted market participation.

Key Words : Volatility, Market Timing, SIP

1. Introduction

The debate regarding optimal capital deployment in equity markets has traditionally focused on lump-sum allocations. However, the global rise of defined contribution pension schemes and automated retail mutual funds has shifted massive volumes of capital toward periodic investment models. Systematic Investment Plans rely on the mathematical framework of dollar-cost averaging to mitigate sequence-of-returns risk. Early literature by Rozeff (1994) and Knight and Mandell (1992) questioned the strict mathematical optimality of dollar-cost averaging compared to

immediate lump-sum deployment. Despite these theoretical critiques, the strategy remains globally ubiquitous due to its behavioural advantages and its natural alignment with monthly income streams.

Even with the foundational premise of passive accumulation inherent in systematic investing, market participants frequently attempt to optimize their cost basis through active timing interventions. Behavioral finance literature demonstrates that individual investors routinely exhibit myopic loss aversion. Consequently, many investors pause periodic equity contributions during extended bull markets when valuations appear stretched. They choose to accumulate cash reserves in risk-free assets with the explicit intention of deploying this capital during subsequent market drawdowns. This specific behavioural pattern acts as a contrarian timing overlay applied directly to a passive cash flow stream.

Extensive empirical work exists on technical trading rules and tactical asset allocation. Brock, Lakonishok, and LeBaron (1992) established the standard methodology for evaluating moving average strategies. Malkiel (2003) and Sharpe (1975) provided the theoretical boundaries of market timing under the Efficient Market Hypothesis. Yet a notable gap remains in testing how timing mechanisms perform when applied exclusively to continuous periodic inflows rather than static portfolios. Assessing this dynamic is particularly relevant in emerging markets like India. The Indian equity market experiences high structural volatility, deep drawdowns, and distinct regime shifts, providing an ideal environment to test whether cash buffering and tactical dip-buying generate measurable excess returns.

This paper empirically tests the efficacy of a tactical market-timing overlay against a standard, unconditional systematic investment plan. We construct a dynamic model utilizing a 6-month Simple Moving Average to intercept and hold scheduled monthly allocations during established uptrends. Using 218 months of dividend-adjusted data from the Nifty 50 Index, we track the exact opportunity cost of holding cash versus the benefit of concentrated capital deployment during corrections. By isolating Time-Weighted Returns and using exact Newton-Raphson root-finding algorithms, we avoid the cash-flow distortions common in retail portfolio backtesting.

Our findings provide direct empirical support for the Efficient Market Hypothesis within the context of periodic investing. We demonstrate that the perceived advantage of buying the dip is entirely neutralized by the cash drag incurred while waiting for a correction. The remainder of this paper is organized as follows. Section 2 reviews the existing literature on dollar-cost averaging and market efficiency. Section 3 details the data sources and the quantitative methodology used to construct the backtest. Section 4 presents the empirical results, including risk-adjusted performance metrics and statistical significance testing. Section 5 concludes the paper.

2. Literature Review

The evaluation of tactical overlays applied to systematic investment plans sits at the intersection of quantitative market efficiency and behavioural finance. To contextualise the empirical backtest presented in this study, the existing literature is categorised into distinct domains: the theoretical framework of dollar-cost averaging, the constraints of market efficiency, the mechanics of moving average overlays, the behavioural drivers of cash holding, and the specific dynamics of emerging markets.

2.1 The Foundations of Periodic Investing and Dollar-Cost Averaging

The academic evaluation of periodic equity investing originates from the ongoing debate regarding the mathematical optimality of dollar-cost averaging versus lump-sum deployment. Early analytical models by Rozeff (1994) and Knight and Mandell (1992) established that lump-sum investing generally yields superior terminal wealth in markets with an inherent upward drift. Bierman and Hass (2004) outlined the mathematical suboptimality of delaying capital deployment. However, Milevsky and Posner (2003) extended this framework into continuous time and demonstrated the stochastic nature of terminal wealth. They proved that periodic investing structurally reduces the variance of the final portfolio value. Recent studies by Panyagometh and Zhu (2016) and Kirkby, Mitra, and Nguyen (2020) evaluate dollar-cost averaging across diverse asset allocations and confirm that while it may not maximize absolute returns, it successfully mitigates downside capture and sequence of returns risk.

2.2 Market Efficiency and the Futility of Timing

Attempts to improve upon passive periodic investing inevitably intersect with the Efficient Market Hypothesis. Malkiel (2003) argues that financial markets rapidly assimilate new information, rendering tactical timing models largely ineffective over extended horizons. Sharpe (1975) quantified the mathematical difficulty of market timing early on. He provided foundational proof that a market timer requires a predictive accuracy rate exceeding 70 per cent to consistently outperform a passive buy-and-hold strategy. Fama and French (2010) support this theoretical constraint by demonstrating that mutual fund outperformance is largely attributable to chance rather than persistent timing skill.

In the specific context of investor cash flows, literature identifies a severe penalty for active timing. Dichev (2007) and Friesen and Sapp (2007) isolate a behavioral gap in fund performance. They show that the dollar-weighted returns actually realized by active investors significantly lag the time-weighted returns published by the funds themselves. This performance drag is directly attributed

to investors executing poorly timed capital entries and exits in a futile attempt to avoid market drawdowns.

2.3 Tactical Overlays and Moving Average Dynamics

Despite the structural evidence against timing, quantitative tactical asset allocation remains prevalent in both retail and institutional frameworks. Brock, Lakonishok, and LeBaron (1992) established the empirical standard for evaluating technical trading rules, showing that simple moving averages have limited predictive power for the stochastic properties of stock returns. Lo, Mamaysky, and Wang (2000) and Faber (2007) validate the utility of these quantitative indicators for risk management in broad tactical asset allocation. Moskowitz, Ooi, and Pedersen (2012) outline the persistence of time-series momentum, while Neely et al. (2014) provide evidence that technical indicators can occasionally forecast shifts in the equity risk premium.

2.4 Behavioral Drivers of Cash Drag and Prospect Theory

The persistence of market timing in retail periodic investing requires a behavioral explanation. The foundational work on Prospect Theory by Kahneman and Tversky (1979) established that the psychological impact of financial losses drastically outweighs the impact of equivalent gains. Statman (1995) applies this behavioral framework directly to dollar-cost averaging, explaining why investors prefer structured, periodic deployments to minimize the potential regret of a mistimed lump-sum investment. Dichtl and Drobetz (2011) confirm that prospect theory effectively explains the popularity of periodic strategies. Yet, this same psychological aversion to loss frequently manifests as excessive individual trading and cash hoarding during market peaks. Barber and Odean (2000) mathematically prove this activity erode terminal wealth through frictional costs and cash drag.

2.5 Market Structure and Systematic Inflows in Emerging Markets

The structural characteristics of emerging markets provide an independent testing environment for evaluating the opportunity cost of tactical timing. Harvey (1995) details the distinct predictability and risk features present in emerging market equities, which exhibit higher volatility and fatter tail distributions than developed markets. Within the Indian equity market, Deb, Banerjee, and Chakrabarti (2007) find that professional mutual fund managers consistently fail to exhibit successful market timing ability despite operating in a highly volatile environment. Kumar and Goyal (2015) confirm through a systematic review that Indian retail investors suffer from the exact same behavioral biases observed in Western markets. Consequently, the Indian market provides a robust empirical setting to test contrarian dip-buying strategies applied to systematic investment plans.

2.6 The Empirical Research Gap

While existing literature robustly covers the suboptimality of dollar-cost averaging against lump-sum investing and evaluates tactical overlays for static portfolios, a significant void remains. Retail and institutional investors do not typically deploy capital from static pools. They primarily invest continuous, periodic cash flows sourced from monthly income. The current literature fails to empirically quantify the exact opportunity cost of applying contrarian timing overlays directly to systematic investment plans. Specifically, empirical evidence remains limited on whether withholding periodic capital during uptrends to aggressively buy the dip during corrections generates statistical alpha. This paper addresses this exact gap by isolating the mechanics of cash drag and active deployment within a periodic investment framework, testing the strategy over an 18-year horizon in a high-volatility emerging market.

3. Data and Methodology

To rigorously test the efficacy of market timing applied to periodic cash flows, we construct a backtesting environment that compares an unconditional investment strategy with a tactical cash-buffering model. The empirical testing framework isolates cash drag and active deployment to quantify their impact on terminal wealth and portfolio volatility.

3.1 Data Sourcing and Index Selection

The empirical analysis utilizes historical data from the National Stock Exchange of India. We select the Nifty 50 Total Return Index as the primary equity proxy. Utilizing a total return index is mathematically required for this analysis because it assumes the continuous reinvestment of dividends. Ignoring dividend yields would artificially depress the buy-and-hold baseline's performance and skew the comparative results. The observation window spans 218 months, from March 2008 to April 2026. This specific timeframe captures multiple distinct market regimes, including the 2008 Global Financial Crisis drawdown, extended bull markets, and the 2020 pandemic volatility shock. The risk-free rate for cash holding is standardized at an annualized 6 percent, compounded monthly, representing a realistic yield for liquid retail debt instruments or institutional sweep accounts in the Indian market.

3.2 The Systematic Investment Plan Baseline (Strategy A)

Strategy A represents the passive control group. The model simulates a retail or institutional investor deploying a fixed allocation of ₹10,000 on the final trading day of every month. This deployment is unconditional. It executes regardless of the prevailing market trend, index valuation, or macroeconomic conditions. Capital is immediately converted into index units at the closing price of the day, fully exposing the accumulated portfolio to the equity market.

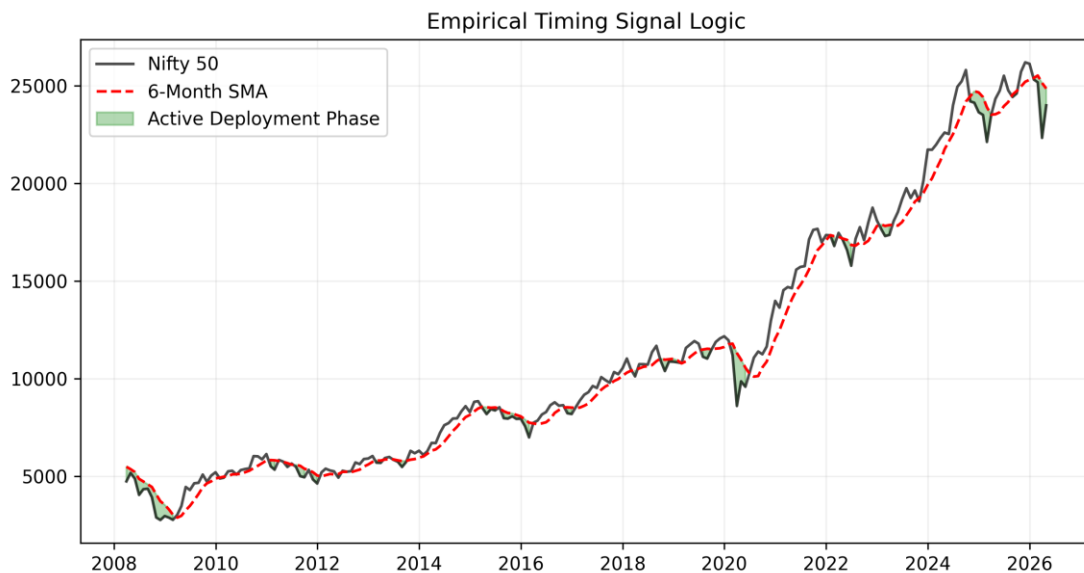
3.3 The Tactical Moving Average Overlay (Strategy B)

Strategy B represents the dynamic, market-timing test group. The strategy receives the exact same monthly inflow of ₹10,000 but subjects the deployment to a strict technical condition based on the 6-month Simple Moving Average of the Nifty 50 Total Return Index.

The strategy logic operates in two distinct phases:

1. The Accumulation Phase: If the index closes above its 6-month moving average, it signals a prevailing uptrend. The strategy interprets this as an unfavorable valuation environment. The monthly ₹10,000 allocation is withheld from the equity market and deposited into a cash buffer yielding the 6 percent annualized risk-free rate.
2. The Active Deployment Phase: If the index closes below its 6-month moving average, indicating a market correction, the strategy executes a dip-buying mechanism. The entire accumulated cash buffer, along with the current month's allocation, is deployed into the equity index in a single lump-sum transaction.

Figure 1: Empirical Timing Signal Logic



3.4 Return Calculation Mechanics

Comparing a steady periodic investment against a strategy with highly irregular, clustered deployments requires precise mathematical handling. Using simple point-to-point returns would introduce severe cash flow timing distortions. To resolve this, we employ the Newton-Raphson root-finding algorithm to calculate the exact Internal Rate of Return for both portfolios. The Internal Rate of Return solves for the single discount rate that sets the net present value of all individual monthly cash flows and the terminal portfolio value precisely to zero.

Additionally, to conduct cross-sectional statistical testing, we extract the Time-Weighted Returns for both strategies. Time-Weighted Returns geometrically link the discrete monthly performance of the invested capital, effectively neutralizing the impact of external cash flow sizing and timing. This isolates the pure performance of the underlying asset allocation decisions.

3.5 Risk Metrics and Statistical Testing

We evaluate risk-adjusted performance using annualized return volatility, maximum drawdown, and the Sharpe Ratio calculated against the 6 percent hurdle rate. To determine if the returns generated by the timing overlay are statistically distinct from the baseline, we run a non-parametric Wilcoxon signed-rank test. The non-parametric test is required because financial return distributions inherently exhibit excess kurtosis and negative skewness, violating the normality assumptions necessary for a standard paired t-test.

4. Empirical Results

The backtest results challenge the assumption that tactical cash deployment improves periodic investment outcomes. Over the 218-month observation period, the quantitative data reveals that the behavioral appeal of buying the dip is mathematically offset by the opportunity cost of holding cash.

4.1 Absolute Wealth and Capital Accumulation

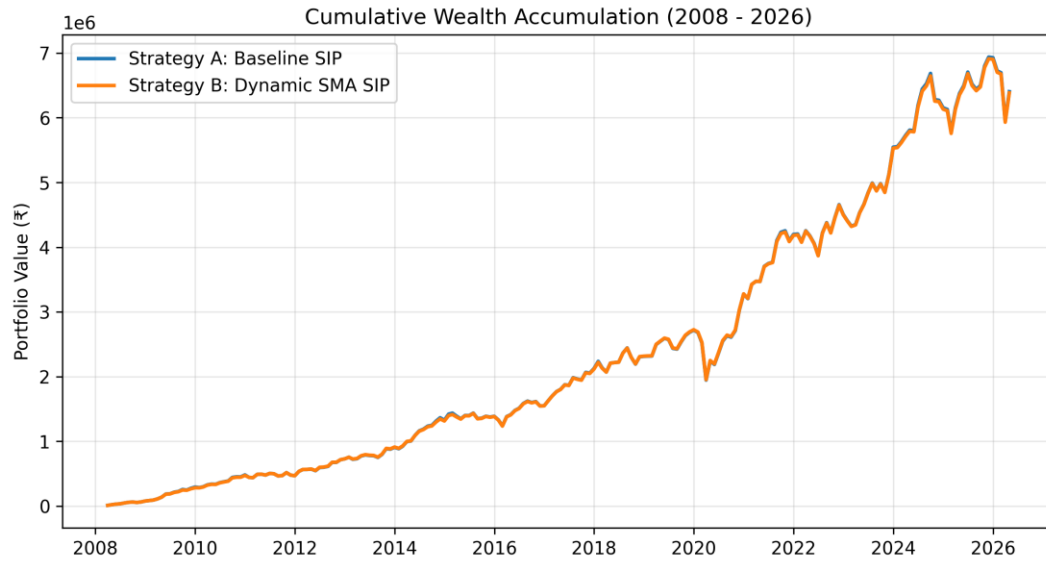
Both strategies absorbed a total capital injection of ₹2,180,000 over the testing horizon. At the conclusion of the backtest, Strategy A generated a terminal portfolio value of ₹6,401,948. Strategy B generated a nearly identical terminal value of ₹6,382,698.

Table 1: Absolute Wealth Generation and Capital Allocation (2008 - 2026)

Metric	Strategy A (Baseline)	Strategy B (Dynamic)
Total Capital Allocated	₹2,180,000.00	₹2,180,000.00
Final Portfolio Value	₹6,401,948.01	₹6,382,698.69
Wealth Multiplier (Per ₹1 Invested)	2.94x	2.93x
Absolute Wealth Advantage	N/A	-₹19,249.32

As outlined in Table 1, both strategies achieved a wealth multiplier of approximately 2.93x. The absolute wealth advantage of the passive baseline strategy over the dynamic timing strategy was a negligible ₹19,249. This indicates that despite executing aggressive, concentrated capital deployments during market troughs, the timing strategy failed to generate any meaningful absolute wealth advantage over simple dollar-cost averaging.

Figure 2: Cumulative Wealth Accumulation (2008 - 2026)



4.2 Risk-Adjusted Performance

The primary mathematical effect of the tactical overlay was a structural reduction in portfolio variance, not an increase in yield. Table 2 displays the risk-adjusted metrics for both models. Strategy A delivered an annualized Internal Rate of Return of 10.89 percent, while Strategy B delivered 10.86 percent.

Table 2: Risk-Adjusted Performance and Statistical Significance Metrics

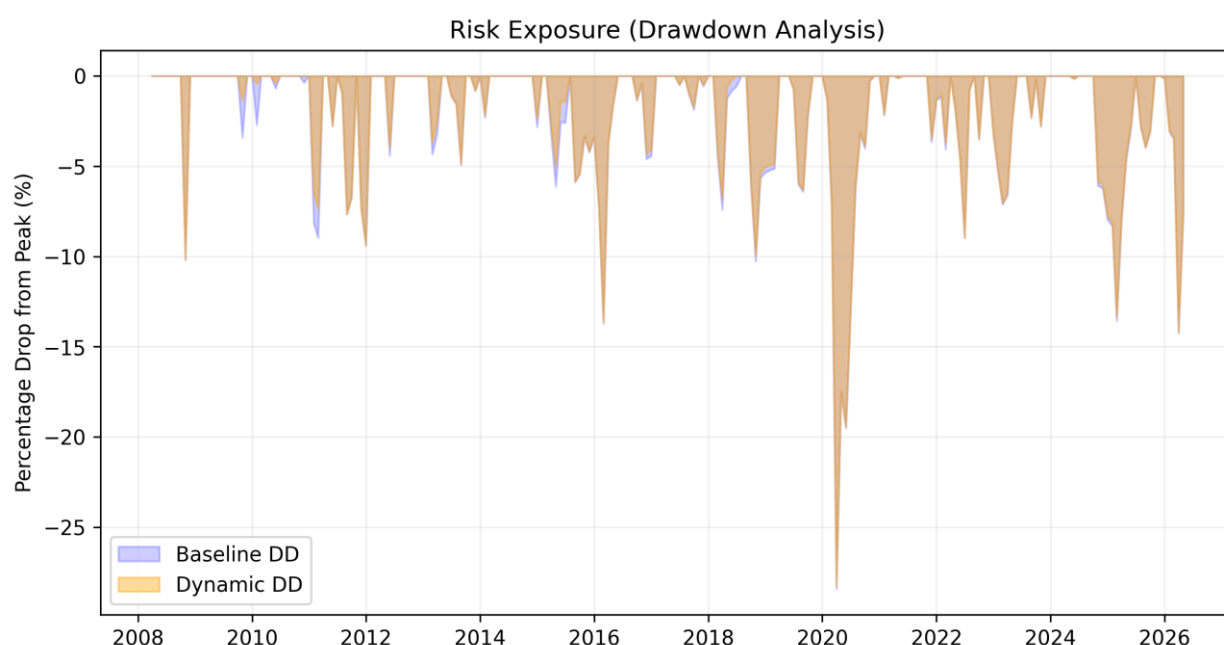
Observation Window: March 2008 to April 2026

Metric	Baseline SIP	Dynamic SMA SIP
Annualized IRR (True Return)	10.89%	10.86
Maximum Drawdown	-28.43%	-28.34%
Return Volatility (Annualized)	19.93%	19.35%
Sharpe Ratio (Risk-Free Hurdle = 6%)	0.170	0.171
Information Ratio (Active Return/Risk)	N/A	-0.0707
Tracking Error (Annualized)	N/A	1.29%
Paired T-test (t-statistic)	N/A	-0.6303
Paired T-test (p-value)	N/A	0.5292
Wilcoxon Signed-Rank (W-statistic)	N/A	7380.0000
Wilcoxon Signed-Rank (p-value)	N/A	0.3949

Note: Return distribution properties indicate a Skewness of -0.34 and Kurtosis of 4.95, necessitating the use of non-parametric testing.

While the returns were essentially identical, Strategy B successfully compressed annualized return volatility from 19.93 percent down to 19.35 percent. This 58-basis point reduction in volatility occurred because Strategy B routinely held a portion of its total capital in a risk-free asset rather than exposing it to equity market fluctuations. Consequently, the Sharpe Ratio for the dynamic strategy marginally improved to 0.171 compared to 0.170 for the baseline. The maximum drawdown profiles were structurally similar, with Strategy A experiencing a peak-to-trough decline of 28.43 percent and Strategy B experiencing a 28.34 percent decline.

Figure 3: Risk Exposure (Drawdown Analysis)



4.3 Statistical Significance of the Timing Overlay

To definitively answer whether the tactical overlay generates measurable alpha, we analyzed the statistical significance of the return differentials. The empirical distribution of the time-weighted returns exhibited a kurtosis of 4.95 and a skewness of -0.34, confirming the necessity of non-parametric testing.

The Wilcoxon signed-rank test yielded a W-statistic of 7380.0 and a p-value of 0.3949. Because the p-value is significantly higher than the standard 0.05 threshold, we fail to reject the null hypothesis. There is no statistically significant difference between the returns generated by the passive systematic investment plan and the tactical moving average overlay. The tracking error of 1.29 percent indicates that the active strategy closely mirrored the baseline performance despite vastly different cash deployment schedules.

4.4 The Mechanics of Cash Drag

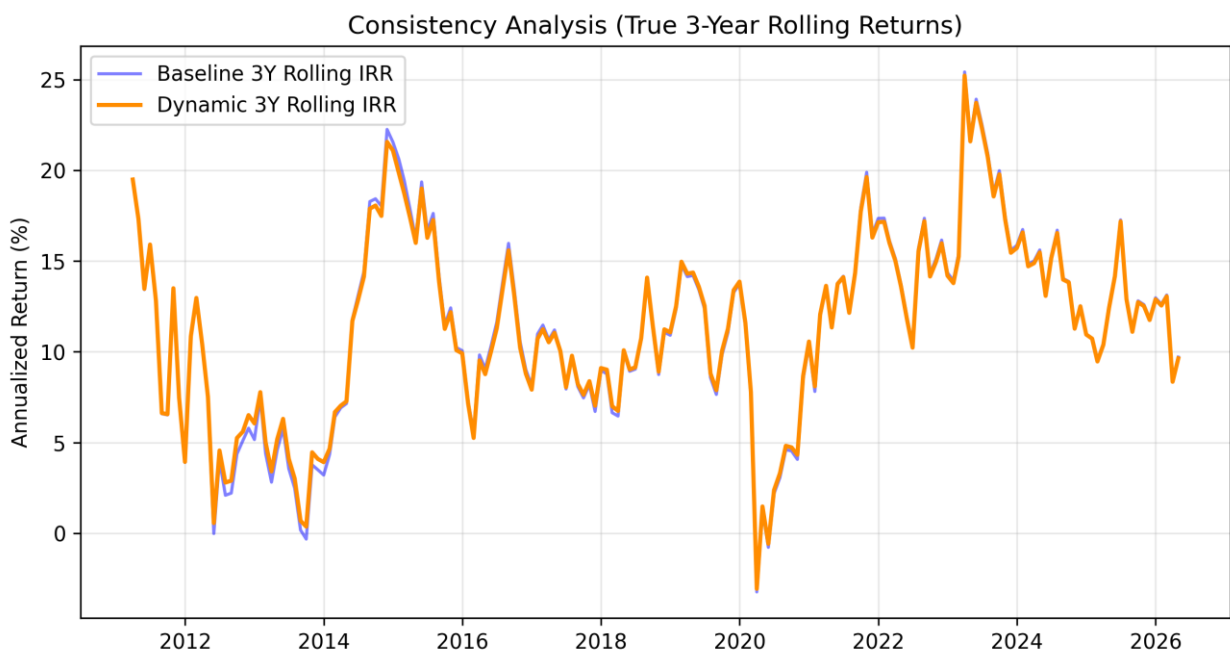
The execution analytics detail exactly why the dynamic strategy failed to outperform. The moving-average overlay logic forced Strategy B to act highly defensively during extended market rallies.

Table 3: Strategy Execution, Cash Buffer Utilization, and Timing Analytics

Execution Metric	Observation / Value
Total Observation Months	218
Months SIP Withheld (Capital safely earned 6%)	142 (65.1%)
Months Cash Deployed (Capital bought the dip)	76 (34.9%)
Maximum Consecutive Months Holding Cash	19 months
Average Wait Time Between Deployment Opportunities	1.9 months
Average Capital Deployed per Dip Event	₹29,309.76
Maximum Capital Deployed in a Single Dip Event	₹209,791.15

As shown in Table 3, the dynamic strategy withheld the monthly capital allocation in 142 out of the 218 months. This means the portfolio was actively hoarding cash 65.1 percent of the time. The strategy only found 76 active deployment opportunities to buy the dip. The average wait time between these deployment events was 1.9 months, with a maximum cash-holding period stretching to 19 consecutive months during a sustained bull market.

Figure 4: Consistency Analysis (True 3-Year Rolling Returns)



5. Conclusion

This study evaluated the efficacy of applying a tactical market-timing overlay to systematic investment plans. By testing a contrarian 6-month simple moving average strategy on the Nifty 50 Total Return Index from 2008 to 2026, we quantified the opportunity cost of withholding periodic cash flows during market uptrends. The empirical results demonstrate that attempting to optimize the cost basis of a systematic investment plan through tactical dip-buying does not generate statistically significant excess returns.

The dynamic strategy successfully identified market peaks and mechanically built a defensive cash buffer, withholding capital in 65.1 percent of the observation months. When market corrections occurred, the strategy executed concentrated capital deployments at lower valuations. However, the internal rate of return calculations reveal that the performance drag incurred by holding cash in a 6 percent risk-free asset completely neutralized the mathematical advantage of buying the dip. The baseline passive strategy and the dynamic timing strategy generated nearly identical annualized returns of 10.89 percent and 10.86 percent, respectively. Wilcoxon signed-rank testing confirmed this variance is statistically insignificant.

The primary structural impact of the tactical overlay was a marginal 58 basis point reduction in annualized portfolio volatility. While this slight dampening of variance mathematically improved the Sharpe ratio, it failed to deliver any meaningful absolute wealth generation over the 18-year horizon.

These findings provide robust empirical support for the Efficient Market Hypothesis within the specific context of periodic retail and institutional cash flows. The data definitively show that the psychological comfort of holding dry powder during perceived market peaks is a behavioural illusion that incurs a severe opportunity cost. Unconditional, uninterrupted participation in the equity market remains the optimal approach for long-term wealth accumulation. The empirical evidence confirms the traditional paradigm: time in the market mathematically supersedes timing the market.

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Digital HR Practices and Human Capital Capabilities for Sustainable Risk Assessment and Claims Management Efficiency in the Non-Life Insurance Sector: A Conceptual Framework – Fasih Uddin Ahmad and Saif Siddiqui

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Abstract

This study aims to conceptualize the role of digital human resource (HR) practices in developing human capital capabilities that enhance risk assessment and claims management efficiency in the non-life insurance sector, with a focus on sustainable operational performance. The study adopts a conceptual research design based on a systematic review and synthesis of prior literature drawn from peer-reviewed and refereed journals. The study develops a theoretically comprehensive conceptual framework by integrating insights from human capital theory, the resource-based view, and the digital transformation literature.

The analysis shows that digital HR practices, including e-HRM systems, HR analytics, and technology-enabled learning platforms, significantly strengthen employees' analytical skills, digital competencies, and adaptability. These improved human capital capabilities are conceptually linked to more accurate risk assessment and greater efficiency in claims management processes in the non-life insurance sector. The proposed framework explores the existing literature by theoretically linking digital HR practices to operational efficiency outcomes through the mediating role of human capital capabilities. It provides a foundation for future empirical studies examining these relationships in insurance contexts. This study presents an integrated conceptual model linking digital HR practices, human capital development, and sustainability-oriented operational efficiency, and provides fundamental theoretical insights to the emerging literature on digital transformation in the non-life insurance sector.

Keywords: Digital HR practices; Human capital capabilities; Risk assessment; Claims management; non-life insurance; Operational efficiency; Sustainability.

1. Introduction

The non-life insurance sector plays a vital role in maintaining economic stability by managing financial risks associated with health, property, and commercial assets. The insurance industry is a cornerstone of modern economies, providing individuals and businesses with financial protection against a variety of risks (Sood & Özen, 2024). In recent years, the sector has undergone significant changes due to rapid digitalisation, increasing data availability, and rising customer expectations for efficient, transparent service. The core operational functions of non-life insurance companies are underwriting (risk assessment) and claims management, which are typically complex, knowledge-intensive, and dependent on human expertise. Studies have highlighted how human capital is an important asset that coordinates and creates a sustainable competitive advantage, in addition to providing capabilities within organisations (Samad, 2020).

Digital HR practices—such as Electronic Human Resource Management (e-HRM), HR Analytics, Artificial Intelligence (AI)-enabled recruitment, and Digital Learning Platforms—are reshaping the way organisations acquire, develop, and deploy human capital. From a theoretical perspective, these practices are seen as strategic supporting factors that enhance employees' competencies, adaptability, and decision-making abilities. In service-oriented industries like insurance, where operational results rely heavily on employees' judgment and analytical skills, the strategic importance of digital HR practices is particularly clear. Modern analytics in the insurance industry uses data-driven methodologies to gain insights into various business aspects and make informed decisions (Valli, 2024).

Human capital theory highlights that employees' knowledge, skills, and abilities are an important source of organizational value. Complementary to this approach, the resource-based view suggests that companies can achieve sustainable competitive advantage by developing valuable and unique resources, including human capital capabilities. In a digitally intensive environment, developing such capabilities largely depends on effectively integrating digital HR systems that support continuous learning, performance monitoring, and data-driven decision-making. Training and development are needed through individual learning and organizational learning to enhance human capital skills (Jusriadi et al., 2021). However, despite the growing recognition of the strategic role of digital HR practices, their specific contribution to operational efficiency outcomes in the non-life insurance sector remains under-explored.

Accurate risk assessment requires analytical ability, data interpretation skills, and contextual understanding, while efficient claims management depends on process knowledge, regulatory awareness, timely decision-making, and proper communication with the insured. Without proper risk assessment, the insurer will charge more for risk to some customers while charging less to

others (Horvey & Odei-Mensah, 2025). Digital technologies have increased the availability of data and analytical tools, yet their effective use depends largely on the capabilities of employees who work with these systems.

Sustainability considerations further enhance the importance of this relationship. In the insurance context, sustainability is not limited to environmental concerns but also includes operational resilience, cost efficiency, and service quality. Efficient risk assessment and claims management contribute to sustainable business performance by reducing operational inefficiencies, minimizing financial losses, and enhancing organizational credibility. Insurers are sensitive to sustainability issues on both the underwriting and investment sides. Risk assessment, pricing and claims management are affected by increasing risks, for example, by natural catastrophes (Aburto Barrera & Wagner, 2023). Therefore, understanding how digital HR practices support these outcomes through human capital development is important from both theoretical and practical perspectives. Although prior studies have examined the strategic role of digital transformation and human capital in the insurance sector, the existing literature often treats these areas separately. Limited attention has been paid to integrating digital HR practices, human capital capabilities, and sustainability-oriented operational outcomes within a unified conceptual framework, particularly in the non-life insurance sector.

To address this gap, the present study attempts to conceptually analyze the role of digital HR practices in enhancing human capital capabilities that contribute to improved risk assessment and claims management efficiency, which leads to sustainability. By synthesizing insights from multiple theoretical perspectives, the study contributes to the emerging literature on digital HRM and provides a structured foundation for future empirical research in this domain.

2. Literature review

2.1 Digital HR Practices in the Context of Service Industries

Digitalization has transformed traditional human resource management functions, leading to the emergence of digital HR practices that integrate information technologies with HR processes. These practices include e-HRM systems, HR analytics platforms, AI-enabled recruitment tools, and digital learning management systems. Early Human Resource Information Systems and electronic HR systems facilitated the digital processing and dissemination of HR-related information, thereby improving administrative efficiency and decision-making processes (Širuček & Galečka, 2017).

In service-oriented industries, where performance is closely linked to employee competence and service quality, digital HR practices play a critical role in supporting talent acquisition, training, and

performance management. Prior research suggests that digitally enabled HR systems facilitate systematic recruitment, personalized learning, and structured evaluation processes (Bord Bia, 2017; Kaushal et al., 2023). The integration of analytics and artificial intelligence further supports evidence-based HR decision-making by enabling real-time data analysis and performance monitoring (Berhil et al., 2019; Tomar, 2021).

Advanced analytics and artificial intelligence have expanded the strategic potential of HR functions by enabling organizations to identify skill gaps, forecast workforce requirements, and assess training effectiveness. AI-based recruitment and assessment tools enhance the objectivity and efficiency of candidate selection and contribute to the development of adaptive workforce capabilities (Chilunjika et al., 2022; Vrontis et al., 2022). However, existing studies indicate that the effectiveness of digital HR systems depends on organizational readiness, technological infrastructure, and employee acceptance (Song & Wu, 2021; Johnson et al., 2022). Without proper alignment between technological tools and organizational culture, digital HR initiatives may fail to generate the expected results.

From a theoretical perspective, digital HR practices can be understood as dynamic organizational capabilities that facilitate knowledge sharing, collaboration, and continuous learning. Through these mechanisms, organizations enhance their ability to respond to environmental and technological changes. In the non-life insurance sector, the increasing reliance on data-driven underwriting and automated claims processing has increased the demand for analytical capability and continuous skills development. Consequently, digital HR practices serve as critical enablers for building the human capital capabilities required for effective participation in digitally mediated insurance operations (Lahoti, 2023; Al-Shammari et al., 2025; Muhammad Arfah, 2025).

2.2 Human Capital Capabilities and Organizational Efficiency

Human capital refers to the collective knowledge, skills, competencies, and experience of employees that contribute to organizational performance. Human capital theory emphasizes that investments in education, training, and skill development enhance productivity and generate long-term organizational value (Adna & Sukoco, 2020). In knowledge-intensive service sectors such as insurance, human capital is a central strategic resource that supports operational effectiveness and service quality (Samad, 2020).

Contemporary research conceptualizes human capital capabilities as organizational-level competencies that emerge through structured learning, collaboration, and performance management systems. These capabilities include analytical proficiency, problem-solving skills, digital literacy, and adaptive capacity, which enable employees to interpret complex information

and respond effectively to dynamic operational conditions (Mikki Ewim et al., 2021; Jusriadi et al., 2021).

From the perspective of the resource-based view, organizations may achieve sustained competitive advantage by developing valuable and unique human capital resources. When supported by appropriate organizational systems, employee capabilities become embedded within routines and processes, thereby enhancing organizational efficiency. Digital HR practices facilitate this process by providing platforms for knowledge sharing, performance monitoring, and competency development (Barišić et al., 2021).

Empirical evidence indicates positive relationships between human capital capabilities and efficiency indicators such as productivity, service reliability, and operational accuracy. In insurance operations, underwriting quality and claims processing efficiency depend largely on employees' analytical competence, regulatory knowledge, and procedural expertise (Sony & Mekoth, 2022).

Moreover, the development of human capital capabilities supports organizational learning and innovation by enabling employees to engage in continuous improvement and effectively utilize digital tools. Accordingly, human capital capabilities function as a critical mediating mechanism linking digital HR practices with operational efficiency in non-life insurance organizations (Teng et al., 2022).

2.3 Risk Assessment and Claims Management Efficiency in Non-Life Insurance

Effective risk assessment enables accurate evaluation of policyholder risk profiles, appropriate premium determination, and financial stability, while efficient claims management supports timely settlement, fraud prevention, and customer trust (Horvey & Odei-Mensah, 2025). Both functions depend heavily on employees' analytical judgment, information-processing capabilities, and regulatory awareness.

The adoption of digital technologies, including electronic claims systems, predictive analytics, and artificial intelligence applications, has transformed underwriting and claims processing by improving data availability and processing speed (Lim et al., 2021; Sadhu et al., 2023; Valli, 2024). Automation facilitates data entry and coding processes, reduces operational errors, and accelerates turnaround times, while advanced analytics enhances risk evaluation accuracy (Machireddy, 2022). These developments have contributed to improved operational transparency and cost efficiency (Ahmad et al., 2025).

Despite these technological advances, prior research emphasizes that underwriting and claims management remain knowledge-intensive activities requiring professional expertise and contextual interpretation. Technological investments alone are insufficient to ensure operational efficiency without corresponding development of employee competencies (Article, 2022; Abu Al-Haija &

Houcine, 2024). Deficiencies in analytical skills, regulatory knowledge, and procedural expertise may result in inaccurate risk assessments, delayed settlements, and increased operational costs. Conversely, organizations that invest in workforce training and capability development tend to exhibit higher levels of underwriting accuracy and claims processing efficiency. In this context, human capital functions as a critical intermediary between digital systems and operational outcomes. Inadequate alignment between technological systems and workforce capabilities may limit the realization of potential efficiency gains (Fadun et al., 2023).

2.4 Sustainability and Operational Efficiency in Insurance Sector

In contemporary business research, sustainability extends beyond environmental considerations to encompass long-term organizational resilience, financial stability, and operational continuity. In the insurance sector, sustainable performance is closely associated with effective risk management, service reliability, and the ability to adapt to evolving regulatory and market conditions (Nogueira et al., 2018). Operational efficiency in core functions such as risk assessment and claims management therefore represents a critical component of sustainable insurance practices.

Prior studies suggest that sustained operational efficiency enables insurers to optimize resource utilization, reduce administrative costs, and enhance service quality, thereby supporting long-term competitiveness and institutional stability (Gatzert et al., 2020). From a systems perspective, sustainability in insurance operations depends on the alignment of technological, human, and organizational resources. Digital transformation initiatives that neglect workforce capability development may undermine performance stability and resilience (Chiaromonte et al., 2020).

Recent literature emphasizes that sustainable operational performance increasingly relies on continuous learning, innovation, and adaptability. In this context, digital HR practices may indirectly contribute to sustainability by strengthening human capital capabilities that support efficient and reliable operational processes (Aburto Barrera & Wagner, 2023). Employees with strong analytical and adaptive skills are better positioned to interpret complex risk information, respond to regulatory changes, and utilize digital tools effectively.

Therefore, sustainability-oriented operational efficiency in non-life insurance can be seen as an emerging outcome of coordinated investments in digital infrastructure and human capital development. By enhancing workforce capabilities relevant to risk assessment and claims management, digitally enabled HR practices support long-term operational resilience and performance consistency (Bressan, 2023; Liu et al., 2023).

2.5 Research Gap and Development of the Conceptual Framework

A review of the existing literature reveals that prior research has focused primarily on the direct effects of digital technologies on operational outcomes, often treating human resource systems

and workforce capabilities as secondary factors. Similarly, studies on digital HR practices have emphasized their impact on employee engagement, performance management, and organizational learning, while insurance-specific operational functions have received limited attention. As a result, the mediating role of human capital capabilities in converting digital HR assets into operational efficiency has been insufficiently studied.

Moreover, existing sustainability-oriented research in the non-life insurance sector has mainly focused on regulatory compliance, financial risk management, and corporate governance, with relatively little emphasis on internal capability development as a driver of sustainable operational performance. An integrated analytical framework linking digital HR practices, human capital capabilities, and sustainability-oriented efficiency outcomes is absent, representing a significant gap in the current literature.

To address this gap, the present study develops a conceptual framework based on human capital theory, the resource-based view, and the digital transformation literature. The framework proposes that digital HR practices enhance employee skills, analytical competencies, and adaptive capabilities, which in turn facilitate more accurate risk assessment and efficient claims management. These operational improvements are expected to contribute to sustainable organizational performance in the non-life insurance sector.

Accordingly, the objectives of the study are as follows:

- 1:** Digital HR practices are positively associated with the development of human capital capabilities in non-life insurance companies.
- 2:** Human capital capabilities are positively associated with risk assessment efficiency and claims management efficiency.
- 3:** Human capital capabilities mediate the relationship between digital HR practices and sustainable operational performance.

These conceptual objectives provide a structured foundation for future empirical research and guide subsequent examination of the proposed relationships.

3. Methodology

This study adopts a conceptual research design based on a structured and systematic review of existing literature. Given the exploratory nature of the present study and the limited availability of integrated empirical evidence linking digital HR practices, human capital capabilities, and operational efficiency in the non-life insurance sector, a conceptual approach is considered suitable.

3.1 Literature Review Procedure

A structured literature review process was used to identify, evaluate, and synthesize relevant academic and professional sources. The review focused on peer-reviewed journal articles related to digital HRM, human capital development, insurance operations, risk assessment, claims management, and sustainability. This approach ensures comprehensive coverage of both theoretical and contextual dimensions of the research area.

The literature search was conducted primarily using Google Scholar, ResearchGate, Emerald, and Sage databases. Keywords and search strings included combinations of terms such as “digital HR practices,” “e-HRM,” “HR analytics,” “human capital capabilities,” “non-life insurance,” “risk assessment,” “claims management efficiency,” and “sustainable insurance operations.” Boolean operators, such as “digital HR practices” OR “e-HRM” OR “HR analytics” AND insurance, “human capital capabilities” AND organizational performance, “risk assessment” AND “non-life insurance” AND efficiency, “claims management” AND “operational efficiency” AND insurance, and “sustainability” AND “insurance operations,” were applied to refine search results and enhance relevance.

3.2 Selection Criteria

To ensure the quality and relevance of the reviewed literature, explicit inclusion and exclusion criteria were applied. Overall, 45 papers were downloaded and studied, out of which 37 papers were selected for the review. The inclusion criteria of the research articles in the present study were based on if they (a) were published in peer-reviewed, refereed, or reputable journals; (b) addressed at least one of the core variables or constructs of the study; (c) focused on service industries, financial services, or insurance-related contexts; and (d) were published predominantly between 2018 and 2026 to reflect recent developments. Eight articles were excluded from this research due to certain criteria, such as unpublished working papers, non-scholarly reports, and opinion-based articles, and articles that did not provide any essential relevant insights. After screening titles and abstracts, we reviewed full texts to assess conceptual relevance and methodological consistency. We removed unwanted or weakly aligned studies at this stage. The final sample included 37 high-quality sources that collectively contributed to the development of the conceptual framework.

3.3 Data Analysis and Synthesis

The selected research articles and studies were analyzed using thematic analysis. Key concepts, theoretical perspectives, research methodologies, and empirical findings were systematically extracted and categorized. This process facilitated themes into three main pillars in the sustainable

insurance context: *the digital driver, the human capital capability, and the strategic outcome.*

Particular attention was given to examining how digital HR systems influence employee competencies and how these competencies affect underwriting and claims management processes that lead to sustainability.

3.4 Framework Development

Based on the synthesized literature, a conceptual framework was developed to clarify the proposed relationships between key concepts. The framework integrates understandings from human capital theory, the resource-based view, and digital transformation literature. Digital HR practices are conceptualized as strategic enablers of human capital capabilities, which subsequently impact risk assessment accuracy and claims management efficiency, thereby achieving sustainable operational performance.

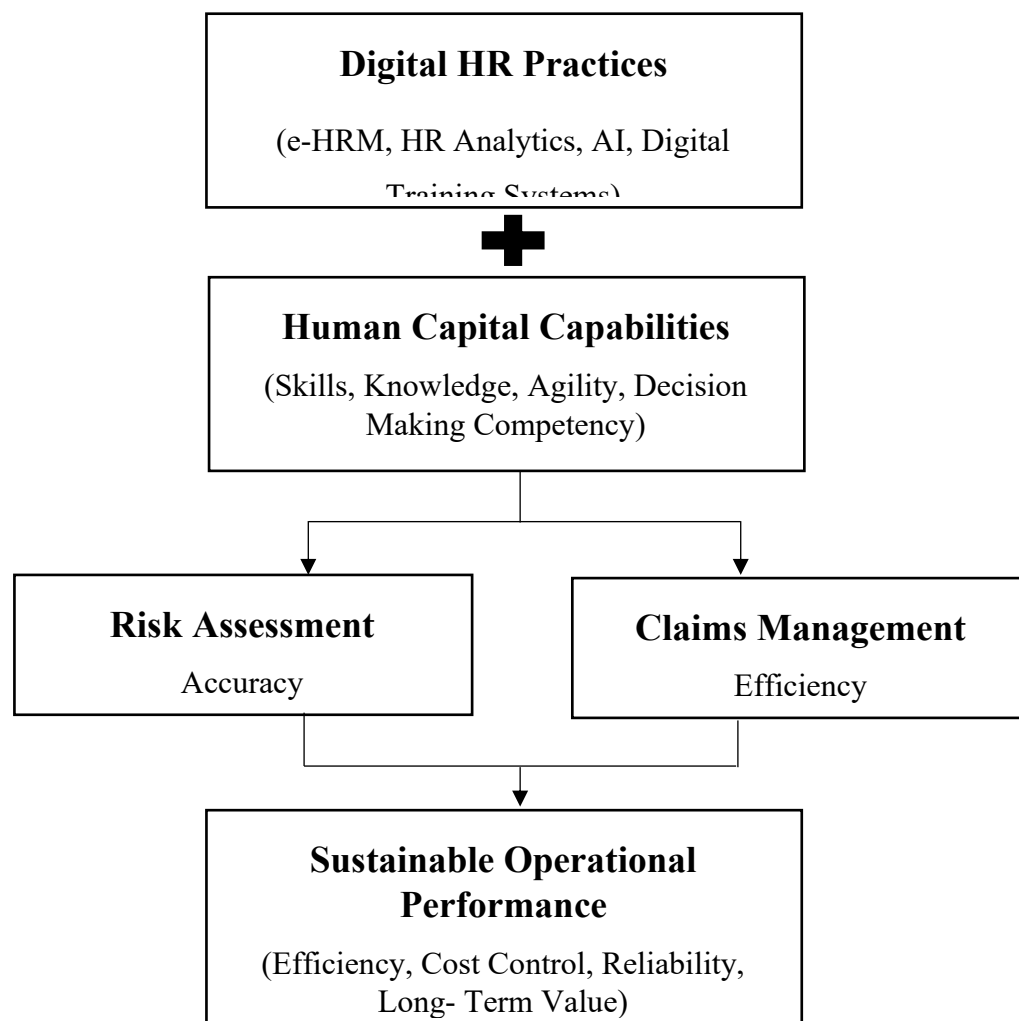


Fig 1. Conceptual Framework.

Source: Researcher's own

4. Findings

Based on the systematic synthesis of existing literature, several interrelated conceptual findings emerge regarding the role of digital HR practices and human capital capabilities in enhancing operational efficiency within the non-life insurance sector. These findings reflect patterns identified across theoretical and empirical studies in human resource management, digital transformation, and insurance operations. HR analytics helps in building a road map to evaluate the performance of employees and improvements required in their performance for development (Tomar, 2021).

4.1 Digital HR Practices and Human Capital Capability Development

The analysis shows that electronic HR systems, HR analytics platforms, and digital learning environments enable organizations to systematically identify skill gaps and monitor performance trends. Many HR analysts use AI algorithms and methods, demonstrating rapid growth in the HR field (Berhil et al., 2019). These practices promote continuous learning and enhance employees' ability to participate in data-driven operational processes. Through these mechanisms, digital HR practices contribute to the development of analytical skills, digital literacy, and adaptability among employees.

Such capabilities are particularly relevant in the insurance sector, where complex regulatory requirements and a dynamic risk environment exist. Moreover, integrating artificial intelligence and predictive analytics into HR processes enhances workforce planning and talent management functions. Consequently, digital HR practices can be conceptualized as foundational supporters of human capital capability development in digitally transformed insurance organizations.

4.2 Human Capital Capabilities and Operational Efficiency Outcomes

A synthesis of prior research reveals a strong conceptual link between human capital capabilities and operational efficiency in underwriting and claims management functions. The non-life insurance sector is highly affected by higher underwriting risk as compared to the life insurance sector and the high level of underwriting risk destabilizes the underwriting performance (Horvey & Odei-Mensah, 2025). Employees with advanced analytical skills, regulatory knowledge, and procedural expertise deliver greater accuracy in risk assessment and more consistent adherence to claims processing standards. These efficiencies reduce error rates, minimize processing delays, and increase operational reliability.

The reviewed literature suggests that adaptable and digitally literate employees are more effective in using automated underwriting tools and claims management platforms. As a result, technological systems and human expertise function and not as substitutes for one another. Moreover, enhanced human capital capabilities facilitate organizational learning and process

optimization. Employees with strong problem-solving and analytical competencies are more likely to engage in continuous improvement initiatives and contribute to workflow standardization. These dynamics support sustained efficiency gains and reduce operational variability across functional units.

4.3 Mediating Role of Human Capital Capabilities

The main finding of this study is the conceptual identification of human capital capabilities as a mediator linking digital HR practices and operational efficiency outcomes. The significant relationship effect between human capital and firm innovative performance can be achieved through the mediating role of human capital (Samad, 2020). While digital HR systems provide infrastructural support, their effectiveness in improving underwriting and claims performance depends largely on the ability of employees to use these systems effectively.

The literature shows that organizations that implement advanced HR technologies without making parallel investments in capability development often experience little performance improvements. In such cases, technological complexity can increase cognitive workload and procedural doubts, thereby limiting efficiency. Conversely, when digital HR practices are integrated with structured learning and development programs, employees are better equipped to convert technological inputs into accurate and timely operational decisions.

Therefore, human capital capabilities can be seen as a transformational mechanism that converts digital HR investments into tangible efficiency results. This intermediary role underscores the interdependence between technological systems and workforce competencies in digitally enabled insurance operations.

4.4 Digital HR Practices, Operational Efficiency, and Sustainability

The findings also reveal that the combined effect of digital HR practices and human capital capabilities contributes to sustainability-oriented operational performance. The more progress there is in insuring ESG (Environmental, Social, and Governance) risks, the better it will be managed in the operations of companies (Nogueira et al., 2018). Improving the accuracy of risk assessment and the efficiency of claims processing improves cost control, service reliability, and organizational flexibility. These results support long-term financial stability and strengthen institutional credibility.

Sustainable operational performance is driven by an organization's ability to adapt to regulatory changes, market volatility, and technological advancements. Digitally supported HR systems enable continuous skill upgradation and performance monitoring, thereby strengthening adaptability. Through these mechanisms, digital HR practices indirectly support sustainability by fostering a capable and strong workforce.

4.5 Synthesis of Conceptual Findings

Collectively, the conceptual findings indicate that digital HR practices influence operational efficiency and sustainability outcomes primarily through their impact on human capital capabilities. This means that more sustainable insurers transfer less risk to reinsurers (Bressan, 2023). Digital HR systems support capability development, enhanced capabilities improve operational processes, and improved processes contribute to sustainable organizational performance.

This synthesis validates the proposed conceptual framework and supports the study's theoretical objectives. By clarifying the impacts on risk assessment and claims management functions through digital HR practices, the findings provide a structured foundation for subsequent empirical research in the non-life insurance sector.

5. Conclusion

This study develops a conceptual framework that explains how digital HR practices affect risk assessment and claims management efficiency through the mediating role of human capital capabilities, which in turn leads to sustainability in the non-life insurance sector. Environmental, Social, and Governance (ESG) integration can help businesses to become more sustainable (Sood & Özen, 2024).

The proposed framework integrates fragmented research streams on digital HRM, human capital, insurance operations, and sustainability-oriented performance. By clarifying the relational mechanisms linking these areas, this study provides a structured foundation for future theory development and empirical investigation.

Overall, the study contributes to the emerging literature on digital transformation in non-life insurance services by emphasizing the central role of human capital in translating technological investments into sustainable performance advantages. For example, by investing in renewable energy and reducing their environmental impact, companies can reduce their carbon footprint and mitigate climate change risks (Sood & Özen, 2024).

6. Limitations

This study has some limitations that should be acknowledged. Since it is based on a conceptual research design, the proposed relationships are drawn from existing literature and have not been tested empirically. As a result, the study does not establish cause-and-effect relationships. Future research using quantitative, qualitative, or mixed-method approaches would be valuable in testing and strengthening the proposed framework.

In addition, the study focuses mainly on the non-life insurance sector, which may limit the applicability of the findings to other areas of financial services. Future studies could explore how these relationships differ across sectors and organizational contexts.

Further research could also examine the influence of emerging technologies, such as generative artificial intelligence and advanced predictive analytics, on HR practices and human capital development. Moreover, investigating cross-cultural and institutional factors may provide deeper insights into digital HRM and sustainability-oriented performance.

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The Planetary Health Readiness Ladder: A Tier-Sensitive Management Framework for Sequencing Capabilities in Resource-Constrained Health Systems – Sadaf Fatima, Iffat Naseem, Sana Ahmad

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Abstract

Health systems are under growing pressure to withstand a changing climate, cut their own environmental footprint, and respond to the health effects that ecological damage is already causing. The frameworks built for this so far have done useful work, they've named the pieces involved: leadership, sustainable service delivery, climate-resilient infrastructure, workforce, technology, financing, accountability. What none of them really say is how a health system should go about tackling those pieces when it doesn't have the resources to do them all at once. A primary health centre, a district hospital, and a tertiary hospital are not working with the same budget, staff, or capacity, yet they're being handed the same list of expectations. This conceptual paper develops the Planetary Health Readiness Ladder, an organisational framework that treats planetary-health readiness as dependent on structural capacity, organisational capability, and external enabling conditions. Drawing on an integrative review of planetary-health scoping reviews, climate-resilient health-system guidance, and organisational theory, including institutional theory, the dynamic-capabilities view, and the WHO's health-system building blocks, the paper proposes four tier-sensitive readiness levels: recognise and organise; measure and improve; coordinate and invest; and lead and learn. It further shows how each level connects to a deliberately narrow cluster of Sustainable Development Goals, principally SDG 3, 6, 9, 12, and 13, so that readiness gains can be reported in a vocabulary already familiar to health-system planners and financing bodies. India's tiered public health system is used throughout as the illustrative context that generated this conceptual problem, with the framework's relevance to other resource-constrained, tiered systems offered as a question for future comparative work. The paper closes with five research propositions

intended to make the framework testable, and an honest account of what remains to be verified before it is ready for submission.

Keywords: *Planetary health; Health system readiness; Tiered health systems; Climate-resilient health systems; Organisational capability; Sustainable Development Goals*

1. Introduction

There is a particular kind of strain that comes from being handed a checklist with no sense of what to do first. Ask a primary health centre in a resource-poor district to reduce its emissions, green its supply chain, install climate-resilient technology, and build a formal accountability system for all of it, and that is roughly the position many planetary-health frameworks put it in. The list is not wrong, every item on it has been shown, somewhere, to matter for a health system's ability to withstand a warming world and to stop making that warming worse. What the list does not do is say which item that primary health centre should reach for first, given that it plainly cannot reach for all of them at once.

This is the practical problem sitting underneath a fast-growing field. Planetary health, the study of how human disruption of the Earth's natural systems feeds back into human health has, in a little over a decade, produced a substantial architecture of frameworks, declarations, and operational guidance. Almost all of it, however, was written with a health system that has meaningful slack in its budget and staffing in mind. Comparatively little of it has been written for the more common situation: a public health system that is tiered by design, chronically constrained at its lower levels, and financed through a patchwork of central schemes, state budgets, and direct household spending.

The stakes of getting this sequencing right are not only organisational. Health systems sit inside a wider architecture of global commitments - most visibly the Sustainable Development Goals, whose targets on health (SDG 3), water and sanitation (SDG 6), resilient infrastructure (SDG 9), responsible consumption (SDG 12), and climate action (SDG 13) all touch, in some way, on what a hospital or health centre does with its energy, its water, its waste, and its buildings. A tiered health system that cannot say what it is realistically able to do this year, and what it should build toward over the next five, is a system that will struggle to report its own contribution to those goals with any precision, whatever framework it eventually adopts. Sequencing, in other words, is not only a management convenience; it is part of what makes SDG reporting from a resource-constrained system credible rather than aspirational, a connection this paper returns to directly in Section 7.

India's public health system is one clear example of this situation, though not, this paper wants to be careful to say, the only one. It is organised into tiers - sub-centres and primary health centres, now being reorganised under Ayushman Bharat as Health and Wellness Centres (Ayushman

Arogya Mandirs); community health centres; district hospitals; and a smaller number of tertiary and teaching institutions, each operating on a different budget, staffing ratio, and administrative capacity, a structure well documented in India's own health-financing scholarship (Behera et al., 2022). Asking every tier of that system to pursue an identical planetary-health checklist at the same pace risks producing the kind of symbolic compliance organisational theory has long warned about: a policy on paper, adopted because it was expected, with little capability behind it. The more useful question is what a primary health centre should build first, what a district hospital can add once that foundation exists, and what only a tertiary hospital is realistically positioned to attempt. That is a management question about sequencing and organisational readiness, not a clinical or engineering one, and it is the question this paper tries to answer.

The paper proceeds as follows. Section 2 sets out how the literature search behind this paper was conducted. Section 3 traces how planetary health became a field of health-systems research. Section 4 uses that field's own most recent self-assessment, together with the closest existing attempts at a maturity-style tool, to show where the guidance available today stops short of a sequencing logic. Section 5 defines planetary-health readiness explicitly and sets out the organisational theory the paper draws on. Section 6 builds the Planetary Health Readiness Ladder itself. Section 7 connects each level of the ladder to a focused cluster of Sustainable Development Goals. Section 8 applies the ladder illustratively to India. Section 9 considers policy implications, Section 10 sets out research propositions and an empirical agenda, and Section 11 closes with limitations that future work will need to address, before Section 12 concludes.

2. Methodology

This paper is a conceptual contribution built on an integrative review. It draws on targeted keyword searches across health-policy, health-systems, and sustainability-science literature, alongside primary World Health Organization (WHO) reports, international declarations, and benchmarking tools, prioritising peer-reviewed scoping and systematic reviews, WHO operational frameworks, and recent governance-assessment and maturity-model tools. The search was updated through September 2026, which is why two 2026 additions, a governance-benchmarking tool (Geffert et al., 2026) and an LMIC facility-resource review (Haider et al., 2026), discussed in Section 4, sit alongside a review search conducted only to November 2023 (Redvers et al., 2025). A formal, protocol-registered, Scopus-indexed search across management, health-policy-and-systems-research, and Indian public-health journals, together with a check of National Health Systems Resource Centre and Ministry of Health grey literature, remains the next necessary step before submission; its absence here is treated as a limitation rather than an oversight (see Section 11).

3. Theoretical Background: The Evolution of Planetary Health as a Field of Health-Systems Research

After the Rockefeller Foundation–Lancet Commission's 2015 report regarding the deterioration of the Earth's natural systems and its effects on the achievements attained in the health of humanity, the term planetary health became prevalent (Whitmee et al., 2015). In a few years, the term evolved from being an argument present in the reports of the commission to a requirement for health systems which must reduce their emissions and wasted capacity and prepare their staff for the climate-induced interruptions already caused by the warming of the planet. The WHO formalized this expectation for the first time in 2015 through its operational framework for climate-resilient health systems, which was expanded upon in 2023 and structured around ten components concerning workforce, technology, leadership, and finance (WHO, 2015, 2023). Around the same time, the widely noted article by MacNeill et al. (2021) in *The Lancet Planetary Health* boiled the expectation down to the principles that a health system manager could: avoid unnecessary care, choose low carbon delivery methods, and monitor environmental performance in the same way as clinical performance. What followed was a proliferation of local answers to the same broad question, including two separate India-based conceptual models for a sustainable hospital, one from a hospital-administration perspective and one from a digital-health perspective (Gupta et al., 2023; Kaladharan et al., 2023). Each of these efforts is a genuine contribution in its own right; together, they left a literature that was scattered enough to eventually need someone to take stock of it.

4. Literature Review

That stock-taking arrived in 2025, when Redvers et al. published a scoping review in *PLOS Global Public Health*. Searching Medline, CAB Abstracts and Scopus alongside grey literature, they identified twenty-six distinct planetary-health frameworks built for health systems and sorted their contents into six recurring categories: the bidirectional relationship between health systems and the environment; vision, advocacy, leadership and communication; structural and governance components; the climate resiliency of facilities themselves; climate-resilient technology and digital infrastructure; and evaluation and accountability.

Two findings from that review matter most for the argument made here. First, twenty-two of the twenty-six frameworks the review found were purely conceptual, only two had been formally validated, and only seven contained any measurable indicator of progress. Second, and more directly relevant, the review's authors state explicitly that identifying which category should come first was never part of their aim: their intention, in their own words, was not to establish a hierarchy among the components they found, and their summary was offered only as a preliminary overview

to support future work. They note directly that the field's heavy emphasis on clinical care leaves comparatively little guidance for non-clinical operations, which makes it, in their words, more difficult for health systems to prioritise implementation, a difficulty they say is felt especially in resource-limited environments — a gap for which they explicitly call for more research.

A second and more recent piece of work sharpens this further. In 2026, Geffert et al. published the PHONIC framework in the *Journal of Global Health* — a tool for benchmarking a country's governance structures for climate-resilient health systems, built through expert consultation and piloted in Germany and Kenya (Geffert et al., 2026). PHONIC is a genuine advance, and it is worth being precise about its boundary: it compares one national government's governance architecture against another's; it does not reach into a single country's own health facilities to compare what a primary health centre's readiness looks like against a tertiary hospital's. Its authors note this limitation themselves, observing that the methodology could in principle extend to the framework's other components without doing so. PHONIC therefore confirms, by the boundary it deliberately draws around itself, that a facility-tier readiness tool remains unbuilt.

The closest existing precedent to a maturity-style tool comes from outside the developing-country literature entirely. Thomson et al. (2023) published a Climate Resilience Maturity Matrix for Canadian health systems in *Healthcare Management Forum*, organising climate action into four chronological phases across six domains of organisational capacity, drawn directly from the WHO's 2020 facility guidance and its 2022 framework for measuring the climate resilience of health systems (WHO, 2020, 2022). This is a genuine precedent for the idea that climate-health readiness can be expressed as a maturity progression rather than a flat checklist, and this paper's own four-level structure owes an intellectual debt to that basic move. But the matrix was built for a single high-income, comparatively well-resourced national health authority; it does not stratify its four phases against facilities holding fundamentally different budgets, staffing, and administrative autonomy, because within the Canadian system that variation is relatively narrow. Applied to a system where a sub-centre and a tertiary teaching hospital sit at opposite ends of a much wider resource spectrum, a maturity progression built for one comparatively uniform system does not, on its own, tell a primary health centre what a district hospital is not yet in a position to attempt.

A second, more recent piece of work confirms this gap from the opposite direction — not from a high-income setting reasoning up, but from the LMIC literature reasoning out. Haider et al. (2026), in a scoping review published in *BMC Health Services Research*, catalogued thirty-three distinct resources for building climate-resilient health-care facilities specifically in low- and middle-income countries. Two of their findings are directly relevant here. First, only about a third of the

resources they found originated from LMIC-based authors, and most of what exists operates at the level of the national health system rather than the individual facility, which the review's authors note makes existing guidance less directly actionable for the people who actually manage a facility day to day. Second, and more pointedly, they report that the resources they found varied considerably in methodological rigour, evidence base, and readiness for use in LMICs, with no standardised way to match a resource's demands to a facility's actual capacity to use it. A scoping review built specifically to answer the question of what LMIC facilities have to work with, in other words, arrives at essentially the same conclusion this paper does by a different route: the guidance exists, but nothing yet tells a resource-constrained facility which parts of it to reach for first.

This governance boundary is not unique to PHONIC, and it echoes the same absence just described from the facility-resource literature. Systematic reviews of health-systems governance frameworks more broadly have found them dominated by qualitative, structural-performance metrics that are rarely climate-specific (Pyone et al., 2017), and more targeted conceptual work on governance for climate-resilient health systems has, so far, stayed at the level of a general overview rather than a tiered decision rule (Robinson et al., 2024). A parallel critique comes from outside health-systems research altogether: Workman et al. (2025), reviewing eighty-eight articles through the lens of Earth System Governance theory, found governance itself under-theorised across planetary health scholarship more broadly, despite governance being the natural lens through which a management scholar would approach this problem. Four independent literatures — governance frameworks, a resource-rich country's own maturity matrix, an LMIC-specific facility-resource review, and Earth System Governance theory — converge on the same absence from four different directions, which is a considerably stronger basis for a paper than any one of them would have been alone.

Stated carefully rather than absolutely: the literature reviewed here — spanning health-system governance frameworks, a Canadian maturity matrix, and a dedicated LMIC facility-resource review — does not yet provide a clearly articulated, tier-sensitive decision rule for sequencing planetary-health capabilities across a public health system stratified by resource level. That is a narrower and more defensible claim than saying no operational or maturity-based guidance exists at all, and it is the specific, now well-triangulated space this paper works in. Before that space can be filled, though, the paper's central term needs a definition it has so far only used loosely: readiness itself.

5. Conceptual Definitions and Theoretical Foundations

The word “readiness” has been used loosely so far, and a paper built around it needs to define the term before building on it. This paper defines planetary health readiness as the organisational

capability of a health facility, or a health-system tier, to initiate, implement, and sustain planetary-health actions appropriate to its resource envelope, administrative capacity, and position within the health-system hierarchy.

Two distinctions follow from this definition and matter for how the framework is used. Readiness is not the same as performance: a facility can have weak current environmental performance and still have high readiness to improve, if the underlying leadership and information capability exist. And readiness is not the same as compliance: a facility that has adopted a sustainability policy document does not necessarily have the organisational capability to implement it, which is precisely the symbolic-adoption risk institutional theory describes.

This paper draws on three organisational lenses to explain how readiness of this kind develops. The first is institutional theory, and in particular DiMaggio and Powell's (1983) account of how organisations facing external pressure and uncertainty often adopt visible structures — a policy, a designated officer, a reporting line, well before the underlying capacity those structures are meant to reflect exists. This is a caution as much as a tool: a facility pushed to adopt a full planetary-health framework at once risks producing exactly this kind of unsustained, symbolic adoption. The second is the dynamic-capabilities tradition in strategic management, associated with Teece et al.'s (1997) argument that an organisation's capacity to do something complex tomorrow depends on the simpler capabilities it has already built today, suggesting that low-cost categories such as leadership and evaluation are not merely cheaper options but the foundation on which capital-intensive categories eventually depend. The third is the WHO's own health-system building blocks, leadership and governance, service delivery, workforce, health information, technologies, and financing (WHO, 2007), which gives the framework a vocabulary that connects directly to how health systems are already organised and assessed, rather than importing a vocabulary from an unrelated domain.

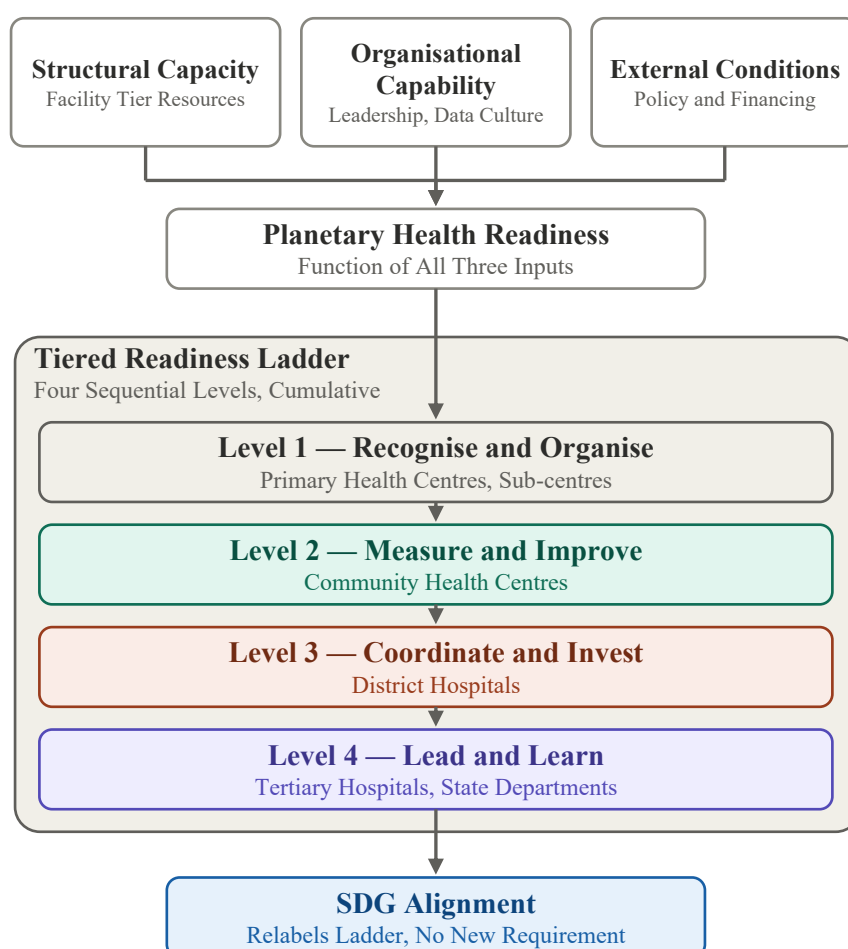
Two further distinctions complete the conceptual groundwork. First, structural capacity and organisational capability are not the same thing and should not be treated as if they were: a facility's tier determines the resources, staffing, and formal responsibilities available to it, but its actual readiness is shaped jointly by that structural capacity, by organisational capability such as leadership quality and data culture, and by external enabling conditions such as state policy, financing mechanisms, and district-level technical support. A well-led primary health centre with an engaged officer-in-charge may reasonably show more genuine readiness than a larger facility with weaker leadership, even though the larger facility sits at a higher tier. Second, and following from this, the placement of specific capabilities within the ladder that follows is not arbitrary; it follows from four criteria - the resource intensity a capability requires, the administrative complexity it demands,

the technical capability it presupposes, and the degree of institutional or financial autonomy needed to sustain it. Capabilities low on all four criteria are treated as earlier priorities regardless of tier; capabilities high on capital intensity and technical complexity are treated as later priorities, reserved for tiers with the administrative and financial autonomy to sustain them.

6. Proposed Framework: The Planetary Health Readiness Ladder

The framework proposed here groups the six categories identified by Redvers et al. (2025) into three functional bands, using the four placement criteria set out above, and expresses tier-sensitive priority across those bands as a ladder. It is a tier-sensitive priority architecture: a statement of which capabilities should typically be prioritised first, given the resource, administrative, and technical conditions ordinarily associated with each tier.

Figure 1: The Planetary Health Readiness Ladder: Conceptual Framework



The three functional bands are summarised in Table 1. Foundational capabilities - vision, leadership, communication, and basic evaluation and accountability, require little capital, technical skill, or administrative autonomy, and are treated as priorities at every tier from the outset. Organisational or enabling capabilities - governance processes, models of care, workforce practices, and planning or procurement routines, require moderate administrative complexity and some institutional autonomy, becoming realistic once foundational capabilities are in place. Capital-intensive or technical capabilities - facility retrofits, climate-resilient technology, and advanced digital infrastructure, require significant capital, specialised technical skill, and financial or contractual autonomy, and are reserved for tiers with the administrative machinery to sustain them.

Table 1: The Three Functional Bands Underlying the Ladder

Functional band	Example capabilities	Resource / technical demand	Where it typically enters
Foundational	Vision and leadership designation; identifying local environmental risks; simple indicators; staff orientation	Low capital; low technical skill; minimal autonomy required	Every tier, from Level 1
Organisational / Enabling	Governance processes; models of care; workforce practice changes; planning and procurement routines	Moderate administrative complexity; some institutional autonomy	From Level 2 onward
Capital-intensive / Technical	Facility retrofits; climate-resilient technology; advanced digital infrastructure; formal evaluation and research	High capital; specialised technical skill; financial or contractual autonomy	Level 3–4

Distributed across India's four public-system tiers, this produces four readiness levels.

Level 1 — Recognise and Organise (primary health centres and sub-centres / Health and Wellness Centres)

At this level, the ladder asks for almost nothing that costs money and almost everything that costs attention: nominating a planetary-health focal person, identifying the facility's main local environmental health risks, adding a small number of indicators to routine review, and folding basic staff orientation into existing training. This is deliberately not where facility retrofits or new technology are expected to appear; a facility running on a modest annual maintenance grant that is pushed straight to capital investment is being set up for exactly the unsustainable, symbolic adoption institutional theory warns against.

Level 2 — Measure and Improve (community health centres)

Building on Level 1, a community health centre with a resident medical officer and a functioning administrative structure can reasonably be expected to track energy, water, and waste use;

introduce low-cost operational improvements; fold environmental considerations into existing procurement; and establish a simple reporting link with district-level technical support.

Level 3 — Coordinate and Invest (district hospitals)

Once that measuring and reporting habit is in place at Level 2, a district hospital is where the ladder can finally ask for real money and real contracts, because it has a real utility budget, a biomedical-engineering function, and enough administrative capacity to enter contractual relationships with outside parties. This is the level at which climate-risk assessment, facility-resilience measures of the kind set out in WHO's own guidance for climate-resilient and environmentally sustainable health care facilities (WHO, 2020), and no-upfront-cost financing arrangements such as energy-savings performance contracts become realistic — not because more money is idle, but because the administrative machinery exists to use such arrangements, provided the enabling state-level policy and financing mechanism has already been created.

Level 4 — Lead and Learn (tertiary and teaching hospitals, and state health departments)

Everything built at Levels 1 through 3 — the focal person, the routine indicators, the district steering group, the contracted financing — culminates here: only at this level does the full range of capabilities become a reasonable expectation. A tertiary hospital or state health department has the scale, finance function, and research capacity to pursue advanced technology, formal evaluation, and training programmes, and is also best positioned to generate the validated evidence the Redvers review found almost entirely absent from the frameworks it reviewed, providing technical support and lessons learned to the tiers below it.

Table 2 summarises this readiness architecture across six practical dimensions, using qualitative labels rather than fixed thresholds, since the paper does not yet have the empirical basis to specify precise cut-offs.

Table 2: Readiness Dimensions Across the Four Levels

Dimension	Basic question	Level 1: Recognise & Organise	Level 2: Measure & Improve	Level 3: Coordinate & Invest	Level 4: Lead & Learn
Leadership	Is responsibility assigned?	Named focal person	Facility-level team	District steering group	Institutional governance structure
Information	Is relevant data available?	Basic register	Routine indicators	Integrated district dashboard	Research-quality monitoring
Operations	Can improvements be implemented?	Low-cost actions	Routine improvement plan	Formal investment plan	Innovation and demonstration

Dimension	Basic question	Level 1: Recognise & Organise	Level 2: Measure & Improve	Level 3: Coordinate & Invest	Level 4: Lead & Learn
Coordination	Can the facility work across sectors?	Referral / contact link	Regular district communication	Joint planning with other departments	Formal partnerships and training
Finance	Can activities be funded?	Existing budget line	Small internal allocation	Pooled or contracted external funding	Strategic and performance-linked funding
Learning	Are results reviewed?	Basic review	Quarterly review	Evaluation and feedback loop	Research and dissemination

7. Alignment with the Sustainable Development Goals

A ladder constructed using the principles of organisational theory may end up being of little value for those who increasingly speak the language of the Sustainable Development Goals. It should, however, be emphasized what is being added to this section: nothing new is added in terms of what the ladder is. If an organization has reached Level 2 of the ladder, it is now Level 2 regardless of whether any of its members are familiar with the term Sustainable Development Goals or not. What follows is therefore merely a re-naming of the previously presented capabilities in Section 6. This section connects the two vocabularies, deliberately keeping the connection narrow rather than exhaustive. Environmental-sustainability and climate-health literatures often attempt to map a single intervention onto ten or more SDGs at once; the effect, more often than not, is to make the SDG connection decorative rather than diagnostic. This paper instead follows a more restrained principle, focusing on the cluster of goals a tiered health system's own operation most directly touch: SDG 3 (good health and well-being), SDG 6 (clean water and sanitation), SDG 9 (industry, innovation and infrastructure), SDG 12 (responsible consumption and production), and SDG 13 (climate action). A sixth goal, SDG 15 (life on land), enters only once the ladder reaches ecosystem-based prevention and biodiversity-sensitive practice — consistent with the ladder's own logic, a later-stage capability rather than a foundational one — alongside SDG 4 (quality education), which becomes relevant once workforce training matures into formal professional education.

Table 3 sets out how this cluster maps onto the four readiness levels. The mapping is deliberately loose at the edges: a Level 1 facility's basic risk register contributes to SDG 3 and SDG 13 in a modest, largely internal way, while a Level 4 institution's research output and technical support to lower tiers can plausibly be reported against the same two goals at a different scale. What changes across levels is less which goals apply, in most cases, and more the maturity and verifiability of the contribution a tier can honestly claim to be making toward them.

Table 3: Illustrative SDG Alignment Across Readiness Levels

Readiness level	Representative activity	Principal SDG links
Level 1 — Recognise & Organise	Naming a focal person; identifying local environmental health risks; basic staff orientation	SDG 3, SDG 13
Level 2 — Measure & Improve	Tracking energy, water and waste; low-cost operational improvements; environmentally aware procurement	SDG 3, SDG 6, SDG 12
Level 3 — Coordinate & Invest	Climate-risk assessment; facility-resilience measures; cross-sector coordination; pooled or contracted financing	SDG 3, SDG 9, SDG 13
Level 4 — Lead & Learn	Advanced technology and digital infrastructure; formal evaluation; workforce education; ecosystem-based prevention; dissemination	SDG 3, SDG 4, SDG 13, SDG 15

It lets a state health department describe a primary health centre's Level 1 activity in the same reporting language it uses for a tertiary hospital's Level 4 programme, without

8. Application to India's Tiered Public Health System

With the ladder built and given a shared reporting vocabulary, the natural next question is what it would actually look like set against a real tiered system, and India is where that question started. India is used here as the context that generated this conceptual problem, not as a completed test case, and the framework is offered as developed from the Indian tiered public-health context, with potential relevance to other resource-constrained, tiered systems as a question for future comparative research rather than a claim made in this paper. India is a useful illustrative setting for three reasons: its public health system is tiered by explicit design; facilities differ substantially in staffing, budget, and administrative capacity even within the same state; and national programmes increasingly acknowledge climate and environmental risk, without yet distinguishing between what a lower-tier and a higher-tier facility can realistically be asked to do about it.

Applied illustratively, sub-centres and primary health centres — now being reorganised as Health and Wellness Centres under Ayushman Bharat — correspond to Level 1; community health centres to Level 2; district hospitals to Level 3; and tertiary and teaching institutions, together with state health departments in their enabling and coordinating role, to Level 4. This mapping is offered as a starting illustration for discussion and eventual testing, not as an implemented or validated assignment.

A tiered readiness vocabulary of this kind would also give India's own Sustainable Development Goals reporting architecture, including the Voluntary National Review process through which the country periodically reports its progress to the United Nations, something more precise to draw

on than a general statement that the health sector is broadly aligned with the goals. Whether that reporting connection is taken up in practice is a matter for policymakers rather than something this paper can determine, but the vocabulary set out in Section 7 is built with that possibility in mind.

9. Policy and Practice Implications

If the ladder holds even loosely against a system as large and varied as India's, its implications reach past any single facility and into the policy and financing architecture around it. Health has moved rapidly up the climate-policy agenda in recent years. The first Health Day at a UN climate conference, held at COP28 in 2023, produced a Declaration on Climate and Health signed by more than one hundred and twenty countries, committing signatories to climate-resilient and equitable health systems and bringing health ministers to the negotiating table for the first time (The Lancet, 2023). Since then, the WHO's operational framework has been revised, and tools such as PHONIC have begun turning its governance component into something a country can benchmark itself against.

This is also where the framework's fiscal logic connects, even if indirectly, to India's wider health-financing agenda. Facility-level operating costs sit alongside out-of-pocket payment as a driver of the catastrophic health expenditure that India's own health-financing scholarship measures using the internationally established methodology of Xu et al. (2003). The fiscal space released by lower-tier readiness gains is therefore not merely an efficiency question; it is connected, if only indirectly, to the same financial-protection outcomes that motivate India's broader health-financing reform agenda, and, by extension, to the same SDG 3 targets on universal health coverage that agenda already reports against.

India's existing health-infrastructure financing architecture — central schemes, state health budgets, and Finance Commission grants — was not designed with planetary-health readiness in mind, and nothing in it currently distinguishes a facility that has built basic environmental accountability from one that has not. A tiered readiness architecture of the kind proposed here gives that financing structure something concrete to attach to: a primary health centre could be assessed and supported against Level 1 expectations rather than judged against a checklist written with a fully resourced hospital in mind. The proposed framework could, on this basis, provide a conceptual foundation for future facility-level benchmarking instruments or tier-sensitive financing mechanisms, though what form these eventually take is a matter for policymakers and future research rather than something this paper can specify in advance.

10. Research Propositions and Future Research Agenda

None of this, however, has actually been tested, which is precisely why the argument has to turn next to the propositions that would test it. The framework is offered as a set of testable propositions rather than a finding already established. Five propositions follow from the argument made above.

Proposition 1: Planetary-health readiness is shaped jointly by facility-level organisational capability and the structural resources associated with a facility's tier, rather than by tier alone.

Proposition 2: Foundational capabilities in leadership, communication, and basic accountability enable later investment in structural, technological, and infrastructural capabilities, rather than substituting for them.

Proposition 3: Tier-sensitive sequencing of planetary-health capabilities is more feasible, and more likely to be sustained, than a uniform checklist applied across all tiers of a public health system.

Proposition 4: External enabling conditions, state financing mechanisms, technical assistance, procurement systems, and cross-sector coordination, moderate the relationship between a facility's organisational readiness and its ability to implement planetary-health actions.

Proposition 5: Facilities that build readiness through the staged accumulation described here will sustain planetary-health activities more consistently than facilities that adopt isolated, capital-intensive interventions without the foundational capability to maintain them.

The most direct next step for testing these propositions is a structured assessment of a small sample of facilities across each of India's public-system tiers against the six dimensions in Table 2, to establish whether readiness clusters by tier in the way the framework predicts, or whether it is driven more by individual facility leadership than by tier alone, a question Proposition 1 already anticipates. A parallel, lighter step would examine whether the SDG mapping in Table 3 holds up when a facility's own reporting officers are asked, independently, which goals they believe their current activities serve, a check on whether Section 7's alignment device reflects how practitioners actually think, or only how this paper has assumed they would.

11. Limitations of the Study

This paper has deliberately stayed at the level of a conceptual argument, and several limitations follow from that choice. The Planetary Health Readiness Ladder has not been tested against any Indian facility, and the placement of specific capabilities within each level, while grounded in the four placement criteria set out in Section 5, is a proposition to be examined.

A second limitation concerns the review method itself: this paper draws on an integrative review with one additional targeted search pass, rather than a single formal systematic search, and a fully

protocol-registered, Scopus-indexed search across management, health-policy-and-systems-research, and Indian public-health journals — together with a systematic check of Ministry of Health and National Health Systems Resource Centre grey literature — has not yet been carried out. It remains entirely possible that unpublished government guidance already contains elements of a tiered logic that an academic-database search would not surface, and this verification step is an outstanding requirement.

A third limitation is conceptual: the framework assumes that facility tier is a meaningful, if imperfect, proxy for organisational capability. Actual readiness may vary substantially within the same tier because of local leadership, geography, financing arrangements, and state-level administrative differences — a variation the framework's own Proposition 1 already anticipates, and which the empirical agenda above is designed to investigate.

A fourth and more fundamental limitation is one the wider planetary-health literature already raises about itself: most existing frameworks, including implicitly the one proposed here, are built from a technocratic, managerial standpoint, and give little space to biodiversity, indigenous knowledge systems, or a more fundamental questioning of growth-oriented assumptions in healthcare delivery. A readiness ladder that sequences organisational capability is a genuine contribution to a genuine gap; it is one way, among others, this problem could be framed.

A fifth limitation concerns the SDG alignment proposed in Section 7: the mapping between readiness levels and specific goals is illustrative and has not been validated against how national or state reporting bodies actually classify facility-level activity, and a narrower cluster of five or six goals, however deliberately chosen, is still a simplification of a much larger and more interconnected set of targets.

12. Conclusion

Planetary health has, in a short space of time, described what an environmentally sustainable health system should contain. It has been far less clear about what a health system with almost no spare capacity should build first. This paper has argued that this is the field's central unanswered question for the tiered public systems that serve most of the world's population. By defining planetary-health readiness explicitly, separating structural tier from organisational capability, grouping existing planetary-health domains into foundational, enabling, and capital-intensive bands, and connecting each resulting level to a focused cluster of Sustainable Development Goals, the Planetary Health Readiness Ladder offers a starting answer: prioritise vision, leadership, and measurement at every tier from the outset; add governance and workforce capability as administrative capacity allows; reserve the most capital-intensive technological ambitions for the tiers equipped to sustain them; and report each stage of that progress in a vocabulary that already

connects to global commitments rather than inventing a new one. The framework is offered here as a set of propositions for testing, the next step is empirical work in India's own facilities.

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Evaluating the trade effects of free trade agreements in India – Harshita Satyawali and Sakshi Bansal

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Abstract:

This study examines India's Free Trade Agreements (FTAs) from 1991 to 2025 and evaluates their impact on trade performance, industrial sectors, domestic competitiveness, and India's position in the global economy. Using a mixed-methods approach combining quantitative analysis, qualitative interpretation, and case studies, the research analyses major agreements including the India–Sri Lanka FTA, India–Japan EPA, India–Thailand FTA, and India–South Korea CEPA, along with India's decision to opt out of RCEP. The study also considers post-pandemic trade developments and India's renewed bilateral FTA negotiations. It highlights how FTAs have created export opportunities while also presenting challenges related to import competition, trade imbalances, and domestic sectoral resilience. The findings provide insights into India's evolving trade strategy and its efforts to balance global integration with domestic economic interests.

Keywords: Free Trade Agreements; International Trade; Trade Liberalisation; Export Competitiveness; RCEP; Trade Policy

JEL: Q56, F5, O33, O34, F210

1. Introduction

A free trade agreement (FTA) is a formal arrangement between two or more countries to lower or remove tariffs, quotas, and other trade restrictions, aiming to encourage greater exchange of goods, services, and resources among the participating nations. Put more simply, it is a pact whose central purpose is to reduce the barriers that would otherwise limit imports and exports between its signatories.

Like most economic policies, free trade carries both advantages and disadvantages. On the positive side, it has enabled many countries to achieve faster economic growth and has made them more attractive destinations for foreign investment, both of which support accelerated development. It also encourages competition, pushing countries to offer their resources at the most competitive prices possible — a dynamic that, in turn, allows manufacturers to lower the cost of finished goods for consumers. At the same time, free trade can leave countries more dependent on international markets than is always desirable. Even when certain goods are available more cheaply abroad, there can be strategic value in producing them domestically, and relying too heavily on imports raises a country's vulnerability to global market fluctuations. Similarly, when a country lowers its trade barriers, domestic producers may struggle to compete with foreign firms, which can lead to job losses and, in some cases, business failures.

This research examines the major free trade agreements India has entered into and assesses their wide-ranging effects on the country's economy, its industrial sectors, and its position in global trade. Central to this study are the India-Sri Lanka Free Trade Agreement (ISFTA), the India-Thailand Free Trade Agreement (ITFA), and the India-South Korea Comprehensive Economic Partnership Agreement (CEPA).

These agreements vary considerably in scope and depth, ranging from straightforward tariff-reduction arrangements to more comprehensive economic partnerships, and this research will explore these differences in detail. Particular attention will also be given to recent US tariff measures, which represent an external shock to the global trading system.

2. Objectives of the Research

The objective of the research is to analyze and examine the applicability, effects and implementation of Free Trade Agreements (FTA) signed by India from 1991 to 2005. The paper aims to shed light on the strategy, economic impacts, and policymaking that moulded India's approach over time.

- To trace the evolution of India's FTA engagement since the 1991 economic liberalization, with emphasis on the structure and trade-liberalization provisions of agreements such as AIFTA, SAFTA, and recent CEPAs.
- To assess the impact of FTAs on India's bilateral and multilateral trade, using historical data from government sources such as the Ministry of Commerce to analyse export-import trends and resulting trade balances over time.

- To evaluate the advantages and disadvantages of FTAs for the Indian economy, examining their contribution to sectoral performance, foreign investment, and export competitiveness, alongside associated risks such as trade deficits, domestic industry vulnerability, and underutilization of agreements.
- To analyse the strategic and geopolitical dimensions of India's FTAs, focusing on their role as instruments of foreign policy, regional integration, and strategic alignment with partner nations.
- To examine external shocks and political factors shaping India's trade policy, with particular reference to recent US tariff hikes and their direct and indirect effects on the Indian economy.
- To analyse the relationship between FTAs and India's financial markets, including how FTA-related announcements affect stock market movements and investor sentiment.
- To offer recommendations for future trade agreements.

3. The review of literature

The role of India in Free Trade Agreements (FTAs) has been the subject of extensive scholarly work within international economics. A pivotal contribution is the study by Pandey and Unnikrishnan (2023) from the Mista Centre for Financial Markets and Economy (MCFME) at the Indian Institute of Management, Ahmedabad (IIMA). Their research investigates India's engagement in FTAs with ASEAN, Japan, South Korea, and South Asian countries, highlighting a decline in export competitiveness, persistent trade imbalances, and significant underutilization of tariff concessions.

Similarly, Khorana, Martínez-Zarzoso, and Olarreaga (2015) provide an analysis of the India-Japan Comprehensive Economic Partnership Agreement (CEPA) using a gravity model, revealing mixed outcomes regarding trade intensification and challenges in realizing full trade benefits.

Addressing India's regional trade agreements, Weerakoon and Thennakoon (2006) examine the India-Sri Lanka Free Trade Agreement to draw lessons for the South Asian Free Trade Area (SAFTA), emphasizing structural issues that hinder optimal trade utilization.

The strategic dimension of India's trade policies is discussed by Chatterjee and Chakraborty (2020), who analyze India's withdrawal from the Regional Comprehensive Economic Partnership (RCEP), weighing trade-offs and strategic interests influencing India's position in regional trade blocs.

Policy briefs and government reports complement these academic insights, with the Centre for Trade and Investment Law (CTIL) providing a comprehensive review in Pandey and Unnikrishnan (2023). Meanwhile, reports from the Ministry of Commerce and Industry (2021, 2024a), the Ministry of Finance (2023), and the Department of Commerce incorporate official trade statistics and assessments of duty structures that contextualize India's FTA performance.

Studies recognize the persistent trade deficit with major East and Southeast Asian partners despite India's expected comparative advantage in sectors like agriculture, minerals, and textiles, as highlighted by Pandey and Unnikrishnan (2023) and supported by government trade data (Ministry of Commerce and Industry, 2024a). Moreover, the limited expansion in services trade—despite India's global leadership in IT and business process outsourcing—is a consistent theme in research and policy analysis (Research and Information System for Developing Countries, 2016).

A key factor contributing to underperformance across FTAs is the complexity of administrative procedures, particularly the Rules of Origin (RoO), preventing the full exploitation of tariff concessions as discussed by Pandey and Unnikrishnan (2023), with underlying data also supported by reports from the Directorate General of Commercial Intelligence and Statistics (2024).

The present research builds on this foundation, extending the analytical window beyond the IIMA paper's 2022 data cut-off to include developments through 2025 — a period marked by India's post-pandemic trade recovery and its renewed FTA negotiations with the European Union and the United Kingdom. This extended scope allows the study to assess the role FTAs have played in shaping India's post-pandemic economic position and its adaptation to an increasingly digital trade landscape.

Beyond this extended time frame, the present study departs from and adds to the existing literature in four key respects:

1. It incorporates a case study of a single high-volume traded commodity, drawing on data from the Ministry of Commerce's official website, to offer a micro-level perspective that complements the macro-level analysis presented in the IIMA study.
2. It addresses the influence of FTAs on the Indian stock market — an area largely unexplored in the IIMA paper — establishing a clearer relationship between FTA-related developments and stock market movements.
3. It examines the trade measures introduced under the Trump administration in the United States, illustrating how third-party trade policy can generate significant spillover effects for a domestic economy such as India's.

4. It concludes with a forward-looking discussion offering possible remedies to the structural and policy challenges identified over the course of the study.

4. Research Methodology

As we research India's FTAs from 1991-2025, the methodology we have chosen encompasses quantitative and qualitative data, including a case study approach. We have considered a mixed-methods approach, in which quantitative data will be analysed with qualitative interpretation. The research methodology is structured as follows-

Data Collection

The report collected data from multiple sources and official websites to ensure accuracy, transparency, and reliability. These sources include the Ministry of Commerce and Industry, the comprehensive partnership Agreement between India and Japan, the Ministry of Steel, Government of India, and 2024 statistics.

These secondary sources were used to collect data for the report. The report also uses existing academic research, notably a detailed report from IIM Ahmedabad, as part of the literature review. Insights from both official quantitative data and quality research reviews ensure that the benefits and impacts of free trade agreements in India have been highlighted and thoroughly explained over the years.

Quantitative Analysis

FTAs of two countries has been analyzed in this (i.e. India-Sri Lanka, India-Japan) after the FTA imposition on the basis of time series data which depicts the growth patterns, trade deficits/surpluses along with sectoral performance which will done through GOI website.

A commodity specific case study will also be taken into consideration where the focus will be on the iron ores which will track the bilateral trade volumes pre and post FTA implementation where the Ministry of Commerce website will be used to extract the data.

Qualitative Analysis

- Impact of external factors will be taken into consideration where specific events like the US tariff increase in 2025 by Trump and India's withdrawal from RCEP will be studied.
- Stock market reaction

Any two FTAs of India and their impact on stock market of both the countries will be studied through the official stock market exchange website.

Data Analysis

The India-Sri Lanka Free Trade Agreements was signed on 28th of December 1998 as the 1st bilateral FTA of Sri Lanka and it entered into force with effect from 1st March 2000 whose main aim was to reduce tariffs on a wide range of goods. A specific focus has been laid on export and import growth and a brief study on the stock market.

India's Export Growth to Sri Lanka (FY 2000- FY2024)

India's exports to Sri Lanka observed an exponential increase from \$499.3 million in FY2000 to \$4.17 billion in FY 2023-24 which led to a growth of 735.2 (Shown in table 1 and 2 followed by diagram).

Table 1: India's Export to Sri Lanka (USD Millions)

Year	Export Value	Growth Highlights
2000-01	499.3	Baseline year before ISFTA impact
2011-12	~3,200	Significant post-ISFTA trade boost
2022-23	5,113.3	Post-crisis rebound; India supported SL significantly
2023-24	4,170.0	Recent official export data from India

Figure 1: India's Export to Sri-Lanka by Year

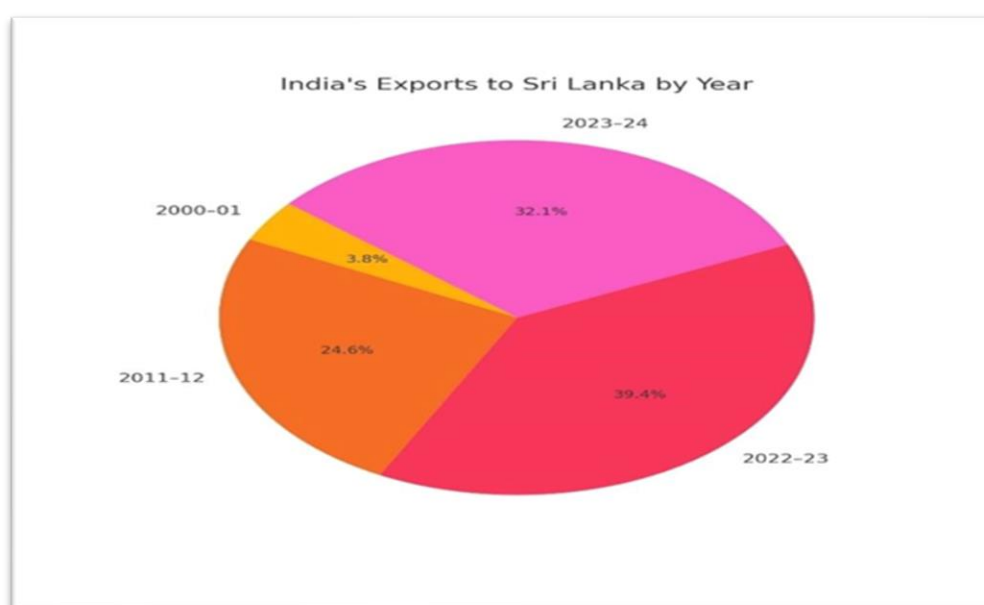
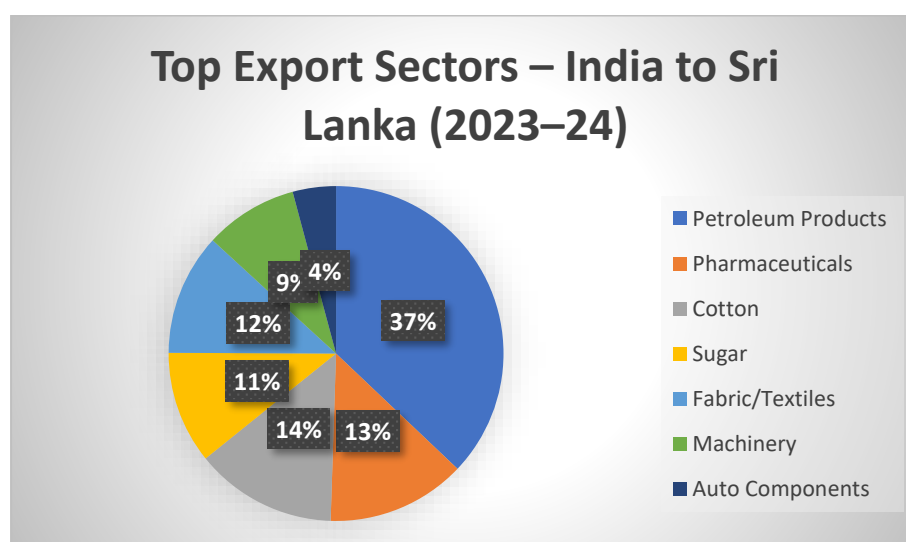


Table 2: Top Export Sectors – India to Sri Lanka (2023–24)¹

Sector	Export Value (USD Million)
Petroleum Products	704
Pharmaceuticals	255
Cotton	260
Sugar	206
Fabric/Textiles	223
Machinery	171
Auto Components	79.3

Figure 2: Top Export Sectors – India to Sri Lanka (2023–24)



Sri Lanka's export growth to India (2000-2012)

Sri Lanka's export growth to India (2000-2012): Sri Lanka's exports to India increased 16-fold from \$45 million in 2000-01 to over \$720 million in 2011-12 (Shown in table 3). Apparel and textiles benefited from duty concessions. For the tea sector, India offered a 50 per cent tariff concession on up to 15 million kg annually. Also, furniture and ceramics were found to be budding export sectors

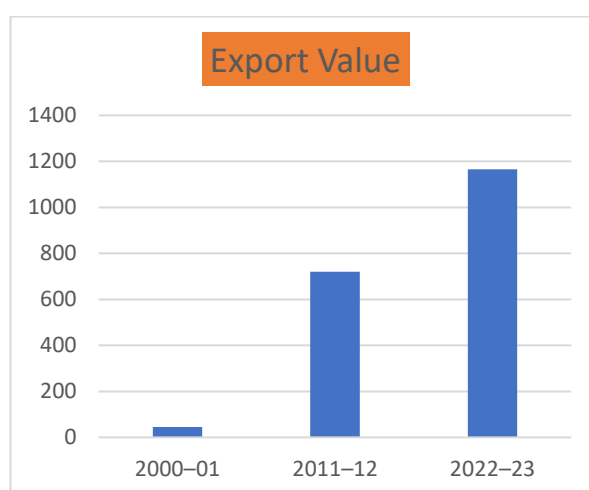
¹ Monthly Export Import Database (MEIDB), Ministry of Commerce and Industry. (2024). India–Sri Lanka Sector-Wise Export Data. Available at: <https://tradedat.commerce.gov.in/meidb/> [Accessed 30 Apr. 2025].

Observation- The graph basically shows dramatic export value growth following ISFTA implementation, with an approximately 16-fold increase from 2000-01 to 2011-12, and continuing to nearly double again by 2022-23. The

Table 3: Export Value Growth

Year	Export Value	Growth Highlights
2000-01	45.0	Baseline year before ISFTA impact
2011-12	720.0	Over 16-fold increase since ISFTA
2022-23	1,165.6	Continued strong export performance

Figure 3: Export Value Growth



Sri Lanka's Imports from India: Sectoral growth

Post ISFTA, Sri Lanka's Imports from India observed a 5-fold increase from \$658 million to \$3.48 billion in 2012 (shown in Table 4)

Table 4: Sri Lanka's Imports from India

Sector	Import Value (USD Mn)	Share of Sri Lanka Imports
Petroleum Products	1,156	30%
Food Products	1,018	48%
Pharmaceuticals	~200+	Significant
Automobiles/Machinery	~150+	Key components supplied

India's import from Sri Lanka

While India's imports from Sri Lanka have also grown but comparatively it is way lesser than the other way around.

Table 5: India's import from Sri Lanka

Sector	Import Notes
Apparel & Textiles	Dominant export from Sri Lanka
Tea	15 million kg annually (concession)
Ceramics & Furniture	Niche growth sectors

The India–Sri Lanka Free Trade Agreement (ISFTA), implemented in 2000 did affect the India's Bombay Stock Exchange (BSE) and National stock Exchange (NSE) Sri Lanka's Colombo Stock Exchange (CSE)—

Sectors:

1. Textiles and Garments

The apparel industry, which is, the breadwinner of the Sri Lankan export system gained immensely due to the introduction of this FTA, where the stocks oriented to this industry experienced a positive return in CSE. India: Indian textile machinery producers faced high demand due to high exports to Sri Lanka, leading to positive performance of textiles-oriented stocks on the BSE.

2. Pharmaceuticals

Indian pharmaceutical companies widened their market share in Sri Lanka, resulting in heightened profits and eventually commending stock movements on the BSE.

3. Tea and Agricultural Products

Widened access to the Indian market allowed Sri Lankan tea exporters to increase revenues, which depicted positive returns on agricultural sector stocks on the CSE.

Sectors That Faced Challenges

1. Small-Scale Manufacturing

Sri Lanka: The introduction of Indian goods heightened the competition, majorly affecting small-scale manufacturers who scuffled to compete with larger Indian firms. This resulted in dissatisfaction.

2. Import-Competing Industries-Both Countries: Industries that were importing from the ally were made to face challenges by high dependence. In Sri Lanka, sectors like plastics and

certain consumer goods faced competition from well-established Indian market, which decreased their stock performance.

Stock Market Indices Overview

Colombo Stock Exchange (CSE): The CSE experienced fluctuating performance after ISFTA.

Bombay Stock Exchange (BSE): Given India's heterogenous and huge economy, the BSE's overall index depicted limited direct impact from ISFTA. However, specific sectors involved in increasing trade with Sri Lanka, such as pharmaceuticals and textiles, may have experienced localized benefits.

India-Japan FTA (2011)

The India Japan Comprehensive Economic Partnership Agreement (CEPA) the India Japan Comprehensive Economic Partnership Agreement (CEPA) was introduced in 2011 which directed at improving bilateral trade by putting an end to tariffs on a huge portion of goods traded between the two countries. While substantial increase in trade volumes was observed, the results were positively skewed towards Japan which experienced more gains.

India's exports to Japan

Post CEPA, India's exports grew from \$4.5 billion in 2010 to \$6.3 billion in 2011 but then eventually the exports declined by first returning to the pre CEPA level and then eventually declining. The high Japanese quality standards limited India's export potential. (shown in table 6).

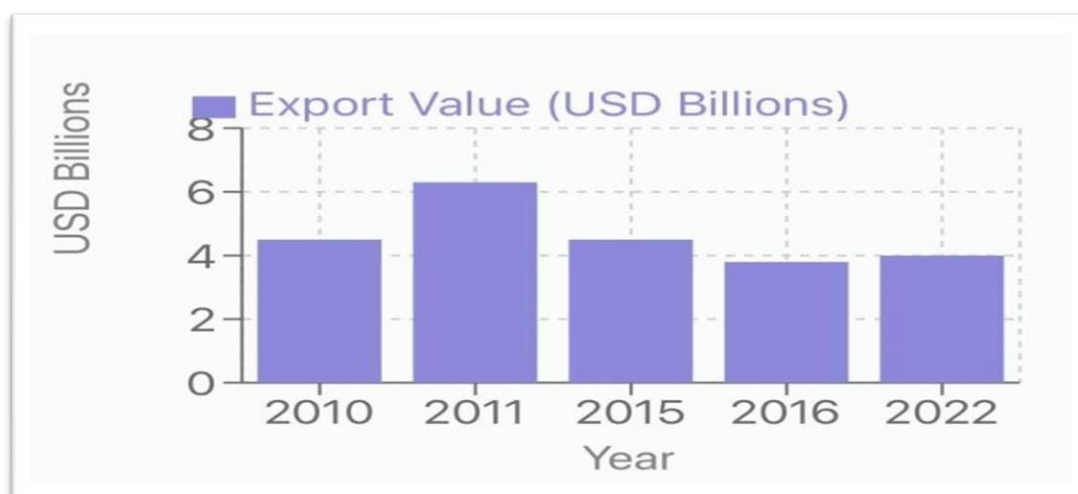
Table 6: India-Japan Export

India–Japan Exports under CEPA

India's Exports to Japan (USD Billions)

Year	Export Value	Observations
2010 (Pre-CEPA)	4.5	Before CEPA implementation
2011	6.3	Initial post-CEPA growth
2015	4.5	Exports stagnated
2016	3.8	Decline due to quality and SPS barriers
2022	~4.0	Slight recovery but limited impact

Figure 4: India-Japan Export



Observation- based on the bar chart, it is showing that India's exports to Japan from 2010-2022, there was a significant peak in export value in 2011 at approx.

\$6.3 billion USD. After 2011, exports declined, with values around \$4.5 billion in 2015, and dropping further to about \$3.8 billion in 2016. By 2022, exports recovered slightly to around \$4 billion, but remained well below the 2011 peak.

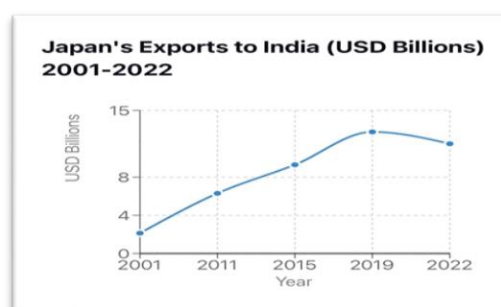
Japan's export to India

After the India-Japan CEPA came into being in 2011, Japan's exports grew 6 times from USD 2.13 billion in 2001 to USD 12.74 billion in 2019 (shown in table 6). Japan's manufacturing sector was much appreciated as the primary exports included capital goods, electronic components, automobile and machinery.

Due to the upper hand of Japan's secondary sector the trade imbalance grew between Indian and Japan resulting in broadening of India's deficit.

Table 6: Japan's Exports to India

Year	Export Value	Observations
2001	2.13	Early trade stage
2011	6.3	CEPA commencement
2015	9.3	Continued growth
2019	12.74	Peak post-CEPA expansion
2022	~11.5	Slight dip, still strong presence



Observation- Based on the graph, Japan exports to India from 2001-2022, there was a consistent upward trend from 2001 to 2019 which representing significant growth over nearly two decades.

India's imports from Japan

India's imports from Japan have increased at an increasing rate after CEPA, observing 6-fold increase. These imports were mainly influenced by capital goods, industrial machinery, vehicles, and electronic equipment. The share of capital goods did decline in 2020-21 (shown in table 7) post Atmanirbhar Bharat launch but the imports of automobiles kept on increasing, demonstrating a strong integration between both the countries.

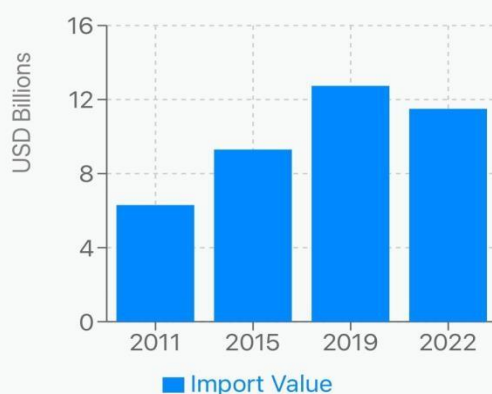
Table 7: India's Import from Japan

Figure 6: India's Import from Japan

India's Imports from Japan (USD Billions)

Year	Import Value	Observation
2011	6.3	CEPA commencement
2015	9.3	Sustained growth
2019	12.74	Peak import volume
2022	11.5	Slight decline from peak

India's Imports from Japan (USD Billions)



Note: 2022 value shown as 11.5 (corrected from -11.5 in original data)

Observation- in this graph we observed that there was a consistent upward trend in India's import from Japan between 2011 and 2019.

Japan's imports from India

Despite CEPA, Japan's imports from India have remained stagnant, oscillating between USD 3.5–4.5 billion post-2011. While the initial period demonstrated growth in marine products and textiles, the exports of fuel and certain agricultural goods sank due to Japan's strict quality and safety standards (SPS and TBT measures). India's market share in Japan remained below 1%, highlighting the perception of Indian goods in Japan's highly regulated and competitive market.

Table 8: Japan's Imports from India

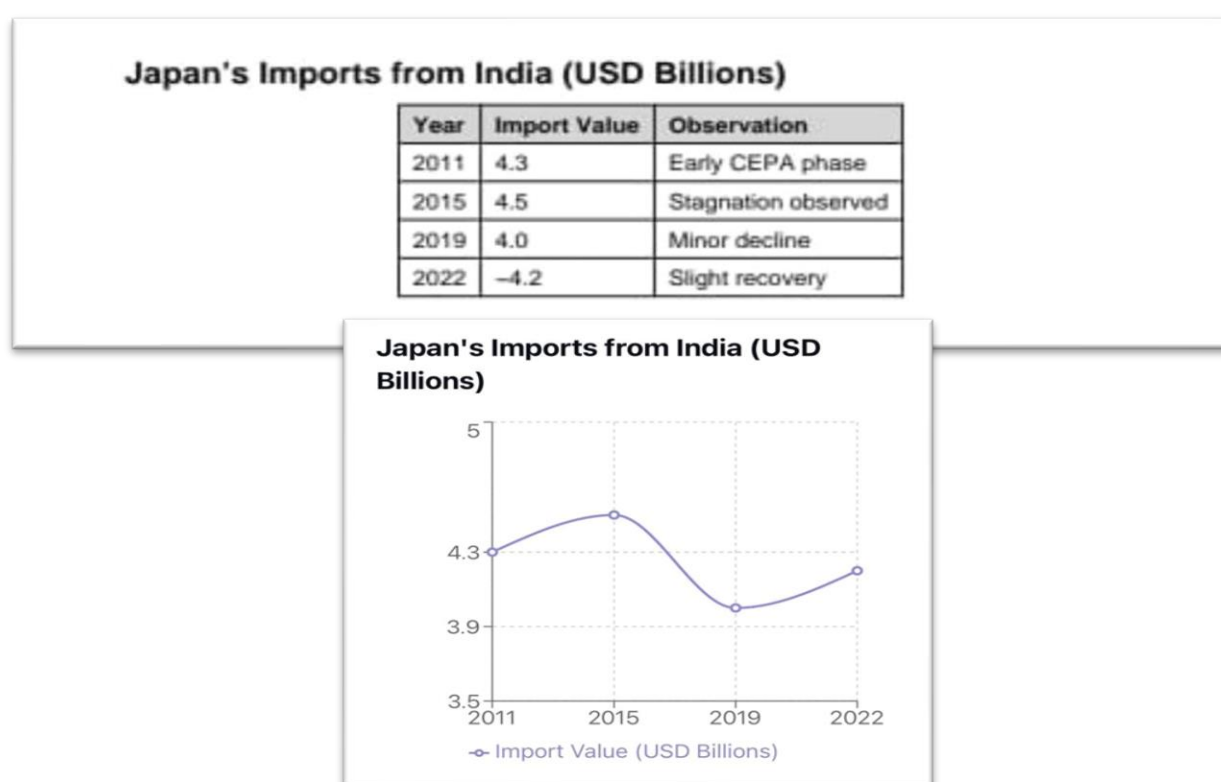


Figure 7: Japan's Imports from India

Observation-

After initial growth following CEPA implementation (2011-2015), imports stagnated, then declined slightly. Overall, Japan's imports from India have remained relatively stable around \$4-4.5 billion throughout the decade. The India–Japan Comprehensive Economic Partnership Agreement (CEPA), introduced in 2011, had a positive impact on Japan's Tokyo Stock Exchange (TSE) but a moderate impact on India's National Stock Exchange (NSE)²

² NSE India. (2024). NIFTY Sectoral Performance Review 2011–2023. Available at: <https://www.nseindia.com> [Accessed 30 Apr. 2025];

Sectors That Gained

1. Pharmaceuticals

India: The CEPA streamlined the approval process, making it easier for Indian pharmaceutical companies to enter the Japanese market.

This positively increased the stock performance of Indian pharma firms.

2. Automobiles and Auto Components

Japan: Japanese automakers took the first mover advantage of the reduced tariffs which led to widening of export system in the India market. It enhanced the growth of automotive stocks on the TSE.

3. Information Technology (IT) Services

India: The agreement led to or collaboration in the IT sector, where Japan had upper hand due to comparative advantage but still Indian IT companies learned a lot from the Japanese technology and widened their services in Japan, which resulted in positive movements in their stock valuations.

Sectors That Faced Challenges

1. Agriculture

India: Despite tariff reductions, Indian agricultural exports to Japan remained stagnant due to Japan's high-quality standards which affected the growth of agro exporters and businessmen and the same was reflected on the agricultural oriented stocks.

2. Small and Medium Enterprises (SMEs)

India: SMEs faced challenges in enjoying the CEPA benefits due to a complicated system and upper hand of the Japanese market, which impacted their stock performance.

Stock Market Indices Overview

India's NSE (NIFTY 50): The overall impact of CEPA on the NIFTY 50 index has been moderate, where sectors like pharmaceuticals and IT depicted growth, some of them highlighted negative trends while majorly of them remained stagnant.

Japan's TSE (Nikkei 225): Japanese exporters, experienced profits due to widened accessibility to the Indian market, positively leading to growth of the Nikkei 225 index.

India, RCEP, and the Shift in Global Trade Strategy Post-U.S. Tariffs (2025)

India, RCEP, and the Shift in Global Trade Strategy Post-U.S. Tariffs (2025) The Regional Comprehensive Economic Partnership (RCEP) is the world's most huge free trade agreement, encompassing 15 Asia-Pacific countries, including China, Japan, South Korea, Australia, and the 10 ASEAN members. The agreement points to decrease tariffs and smoothen trade across the region, shaping about 30% of global GDP.

India was primarily a major participant in RCEP negotiations but pulled back in

November 2019 due to the following reasons-

- Increasing of imports from China depicting dependence.
- Exploitation of domestic workers
- Inadequate market access for Indian services and the major impact on agriculture and MSMEs
- India laid focus on trade balance agreements that offer reciprocal benefits and shielding to the domestic workers.

Impact of U.S. Tariffs under Trump Administration (2025)

In 2025, under President Donald Trump's second term, the US levied tariffs on imports, affecting many countries, including India. This nationalist move led to asymmetric global trade dynamics and led to rebellious movements.

For India, the U.S. tariffs constituted a provocation, especially for export driven sectors like pharmaceuticals, textiles and steel. Rather than retaliating with counter tariffs, India opted for a calculated technique.

India's Response and Trade Policy Realignment

India's approach to the 2025 tariff disturbance was multi-faceted-

1. Bilateral Engagements with the U.S.:

India proposed a modern mediation, providing tariff concessions on U.S. goods (e.g., medical devices, energy, agricultural products) and proposed a "forward most-favored-nation (MFN)" clause which meant India would grant U.S. the best terms it offers any other partner in WTO.

2. Strategic Withdrawal from RCEP:

India's earlier way out from RCEP proved to be an intelligent decision as it denied exposure to massive inflows of subsidized Chinese goods amid increased global protectionism.

3. Widening of Trade Agreements:

India primarily focused on enhancing bilateral FTAs with the EU, UAE, Australia, and the UK, whose goal was to improve the growth rate of the economy

4. Protecting Sensitive Sectors:

India introduced protections for dairy, agriculture, and MSMEs, following the post trade policy according to the Atmanirbhar Bharat (Self-Reliant India) vision.

5. Focus on Market Access & Non-Tariff Barriers:

India opted for a mutual market access, as well as the removal of non-tariff barriers.

Considering the commodity specific case, we have taken the example of commodities in the heavy steel industry. India imported 8.32 million tons of finished steel in the fiscal year 2023–2024, a 38% increase over the previous year. India became a net importer of completed steel during this time due to this surge. About 62% of these imports came from nations with which India has free trade agreements, including South Korea, Japan⁶, and ASEAN countries. Due to the duty-free imports made possible by these agreements, traditional tariff-based protective measures are less effective (shown in table 9).

TABLE OF ANALYSIS 9:

Sr. No.	FTA / Partner Country	Value of Imports (₹ Crore)	Duty Saved / Potential Duty Saved (₹ Crore)	Remarks
2	ASEAN	2,398	62.0	Raw material imports account for approximately ₹2,354 crore, including coking coal from Indonesia (₹2,295 crore), dolomite from Thailand (₹24 crore), and limestone/fluxes from Vietnam (approximately ₹35 crore). Stores imports are approximately ₹43 crore.
3	Australia	59,440	1,141	Approximately 72% of total imports are from Australia. Major imports comprise coking coal (₹59,377 crore), along with coke and semi-coke of coal (approximately ₹53 crore), valves (₹6 crore), and manganese ores (₹3 crore). Duty on major imports, particularly coking coal, was reduced from 26 December 2022.
4	Japan	364.6	24.0	Imports primarily consist of capital goods and stores. Most imports attract 0% duty. However, certain HS lines, including 848390, 842951, 401180 and 850152, account for approximately ₹70 crore of imports and may be considered under an FTA review mechanism. Approximately ₹5 crore in duty may have been paid on these items.
5	South Korea	97.0	5.6	All major HS lines attract 0% import duty, except for Hot-Rolled (HR) Coils.
6	UAE	2,239	30.6	Imports primarily consist of raw materials, including limestone (₹1,769 crore), dolomite (approximately ₹121 crore), other minerals (approximately ₹154 crore), and chemicals (approximately ₹88 crore).

Now considering the impact of FTA over the course of time precisely the FTA signed before and after being signed.

Table 10: The Impact of FTA

Parameter	1990s	2025
Number of FTAs	0-2 (Limited trade agreements)	13+ major FTAs incl. ASEAN, Japan, Korea
Iron & Steel Exports	~\$1-1.5 billion/year	~\$4.5 billion (2023), down from \$13.4B (2022)
Iron & Steel Imports	<\$500 million/year	~\$9-10 billion est. (~8.3 million tonnes)
Major Export Destinations	USSR, UK, Middle East	UAE, Vietnam, USA, Italy, Nepal
Major Import Sources	USSR, Europe	China (2.7 MT), Korea (2.6 MT), Japan (1.3 MT)
Trade Balance	Positive (more exports)	Negative (Deficit: 1.1 MT FY24)
Import Tariffs	High (40-100%)	0-5% (FTA duty-free access)
Policy Protection	Strong (licenses, tariffs)	Liberalized, limited safeguard tools
Domestic Impact	Protected, stable growth	Under pressure, margin loss

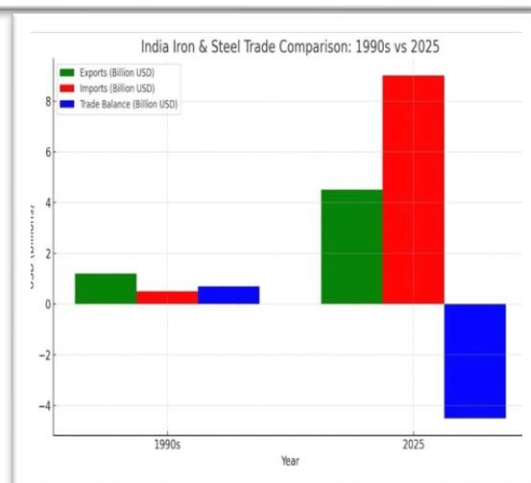


Figure 9: Trade Comparison

⁶ Ministry of Commerce and Industry. (2021) Available at: <https://commerce.gov.in>. [Accessed 30 Apr. 2025].

⁷ Ministry of Steel, Government of India. (2024). Steel Import Statistics and FTA Implications. Available at: <https://steel.gov.in>. [Accessed 30 Apr. 2025].

Conclusion

India's experience with Free Trade Agreements reflects a story of learning, adapting, and steadily growing stronger in the global trade arena. Starting with the India–Sri Lanka FTA in 2000, India took its first step into a world where trade barriers were lowered, giving rise to new export opportunities. Indian companies, especially in pharmaceuticals, petroleum, and

textiles, gained significant ground. On the other side, Sri Lanka's tea and garment exports found a larger market in India. However, like any trade partnership between a larger and smaller economy, the balance wasn't always even. While India saw robust export growth, Sri Lankan small-scale producers often struggled with the rising competition. But this experience helped both countries understand the need for fair, flexible, and mutually beneficial agreements.

With Japan, India entered a different kind of trade dynamic. Japan, known for its world-class manufacturing and already liberal trade regime, was quick to increase its exports to India. Indian businesses, though ambitious, faced challenges due to Japan's high product standards. Despite this, Indian sectors like IT and pharmaceuticals found their niche and made meaningful inroads. This proves that with the right support and preparation, India can perform well even in competitive and regulated markets. India's decision to opt out of the RCEP agreement marked a turning point. It wasn't about turning away from global trade—it was about prioritizing domestic resilience. With concerns over unchecked imports and safeguarding jobs and livelihoods, India chose to protect its market, especially for its farmers. Since then, India has smartly shifted its focus to bilateral trade deals—choosing to work closely with countries like Australia, UAE, and those in Europe, where the terms are better aligned with its economic interests.

Recommendations

- 1. Strategic FTA Reviews:** India should continue reviewing existing FTAs with an aim to fine-tune them—not just to address trade gaps, but to update them in line with current global trends and domestic priorities. A flexible review system will keep India ahead of the curve.
- 2. Boosting MSMEs through Global Linkages:** More government-backed programs should connect small businesses to international buyers, helping MSMEs become part of global supply chains instead of getting sidelined.
- 3. Enhancing Quality and Standards:** With targeted investments in labs, certifications, and compliance support, Indian products—especially from rural and semi-urban regions—can better meet international standards and expand into premium markets like Japan, the EU, and Australia.
- 4. Smart Export Diversification:** India should leverage its growing capabilities in digital services, green technology, renewable energy, and agro-processing to explore untapped markets across Africa, Southeast Asia, and South America.

- 5. Securing Sensitive Sectors with Transition Timeframes:** While opening markets is essential, India must continue to protect critical sectors like dairy, steel, and agriculture by ensuring phased implementation of trade liberalization, giving time for businesses to adjust.
- 6. Skill India for Global Trade:** National skilling programs should be integrated with export sectors, ensuring that Indian workers are prepared for global demands in areas like green manufacturing, digital tech, pharma, and electronics.
- 7. Participatory Trade Policymaking:** Trade decisions should involve the voices of farmers, industry groups, youth, and civil society. This will ensure that India's trade moves are inclusive, sustainable, and widely supported across all sectors.
- 8. India as a Fair-Trade Partner:** India should continue being a responsible trade partner—offering balanced terms, supporting sustainable development, and respecting the economic sovereignty of its partners. This will strengthen India's global image and trust.

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Digital Health Portals and Patient Satisfaction in Medical Tourism: A Dual-Respondent Study - Hurrin Zia, Bhupinder Chaudhary, Mehvish Siddique, Ishrat Rasool, Samiyah Khan

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Abstract

In this research paper, we assess the influence of digital health portals and mHealth apps on the experiences of international medical tourists visiting Indian hospitals. Furthermore, we evaluate the effect of such digital platforms on the operations of the hospitals that cater to such tourists. India's position as an upcoming medical tourism hub has gained traction after the launch of the Heal in India initiative and the Ayushman Bharat Digital Mission (ABDM) by the Government of India. The initiatives have accentuated the importance of digital health infrastructure in terms of providing access, transparency, and continuity of care to patients traveling from abroad. Despite such a considerable investment, empirical evidence proving the effectiveness of digital health infrastructure in improving patient satisfaction and operational efficiency is still scarce. Adopting a quantitative and cross-sectional research design, we collected data via a structured survey from 100 respondents, consisting of international medical tourists as well as hospital IT managers working in accredited Indian hospitals. Descriptive statistics reveal that satisfaction levels are at moderate to high levels ($M = 3.41\text{--}3.74$ on the 5-point scale) in terms of usability, reliability,

information quality, patient experience, & overall satisfaction. Correlational analysis reveals that Patient Experience ($r = .52$) and Operational Performance ($r = .45$) are the most significant correlates of overall satisfaction while the technical aspect of usability has a relatively weaker correlation, affirming the Technology Acceptance Model's assumption of the prevalence of perceived usefulness as opposed to only considering ease of use. Providers have indicated that they face issues regarding inter and intra-system connectivity, cybersecurity, and staffing capabilities. The results indicate that digital health platforms played a very important role in the advancement of medical tourism in India, however, it still requires continuous efforts to enhance usability, integration, and governance of the system to maintain a stronghold in the field.

Keywords: *Digital Health Portals; Medical Tourism; Mobile Health Applications; Patient Satisfaction; Ayushman Bharat Digital Mission; India; Technology Acceptance Model*

1. Introduction

The healthcare industry's globalisation has created medical tourism, which is a fast-growing branch of the international services economy, where people leave their countries to receive either affordable or timely care or treatment unavailable at home. The willingness to go abroad for treatment results not from chance, but rather from the need to respond to such factors as costly healthcare in wealthy countries, long waiting lists in public healthcare systems, and growing customer demands about quality and choice. Current estimates from the industry show that the medical tourism market size will play between USD 30.5–53.3 billion in 2024, while forecasts suggest that it will keep growing into double digits, reaching between USD 142 billion and USD 186 billion by 2032–2034 ([World Tourism Organization \[UNWTO\], 2024](#)). For a long time now, one of the dominating markets in the medical tourism industry has been Western Europe, Thailand, and Singapore, but, nowadays, costs and medical services quality are not enough to attract clients. The new key factor for attracting clients is the total quality of the patient's journey.

India has established itself as a serious player through its combination of affordability and medical expertise. Treatment in India is reported to be 60-90% cheaper than the corresponding procedures in Western countries, thanks to the vast pool of doctors trained abroad and English-speaking doctors, and also a growing number of hospitals accredited by global organizations ([Medhekar, 2020](#)). This value proposition is further supported at the level of government policies, through the Heal in India initiative of the Government of India which is closely linked to the Ayushman Bharat Digital Mission – a national initiative aimed at the development of efficient digital healthcare

infrastructure and the establishment of secure digital health records of the patients ([MoHFW, 2022](#)).

Thus, digitization is an integral part of medical tourism strategy of India. From the beginning of the patient's journey which entails searching information and selecting the service provider, to the treatment in India and rehabilitation, advanced technologies come to replace old forms of communication that used to be applied in the course of international healthcare services. Thus, different hospital chains had to advance; for instance, 'Apollo 24/7' platform, developed by Apollo Hospitals, and 'eClinic' service by Medanta currently manage major stages of the international patients' journey from teleconsultation booking to secure communication and following up on post-surgery condition ([Manteghinejad & Javanmard, 2021](#)). Nevertheless, despite significant cost incurred on these technologies, there is still no persuasive evidence which makes it possible to establish the link between the use of these digital tools and the patient-reported outcomes and, conversely, the pressure that these digital solutions exert on hospitals, which use these services simultaneously. The present research tries to deal with this problem by analyzing the impact of digital health communication systems on the medical tourism in India in order to produce efficient recommendations on how to keep the competitive advantage of the country in this field.

2. Literature Review

2.1 Digital Health in Global Healthcare Delivery

The domain of digital health technologies encompassing technologies like patient portals, telemedicine applications, and mHealth apps has permeated conventional healthcare systems globally prompting a major shift in how patients procure, evaluate and respond to medical information ([Stoumpos et al., 2023](#)). According to the WHO, digital health is understood as an instrumental foundation of universal health coverage with a strong assertion that effective digital infrastructure is able to diminish access and continuity challenges in healthcare rather than just re-organizing the existing operations. Apart from advantages in the sense of providing services to medical services, various research studies revealed that using patient portals positively influences patients' treatment compliance, motivates patients to interact with physicians more actively, and allows increasing patients' satisfaction comparing to traditional forms. For medical tourists specifically a population that must contend with language barriers, geographic distance, and constrained post-discharge access to their treating clinician digital portals perform a function that goes beyond convenience: they are frequently the only reliable channel through which continuity of care can be maintained once the patient has returned home.

2.2 India's Digital Health and Medical Tourism Ecosystem

India's digital health trajectory has been shaped substantially by public policy. The Heal in India campaign and the Ayushman Bharat Digital Mission together aim to establish an integrated, interoperable health information ecosystem capable of supporting standardised patient data management for domestic and international patients alike ([MoHFW, 2022](#)). [Medhekar \(2020\)](#) argue that India's comparative advantage in medical tourism rests not solely on cost and clinical quality but on the relatively early institutional adoption of digital platforms that allow international patients to engage with providers before arrival and remain connected after departure. At the hospital level, this is visible in platforms such as Apollo 24/7, which allows international patients to schedule consultations and manage subsequent communication entirely within the application, and Medanta's Digital Clinic, a patient-centred ecosystem that relies on videoconferencing to sustain the clinician relationship through the post-pandemic period ([Manteghinejad & Javanmard, 2021](#)).

2.3 Determinants of Patient Acceptance and Satisfaction

At the same time, a parallel stream of research has studied the reasons some patients choose to use or avoid digital health tools. According to [Kinney and Sankaranarayanan \(2021\)](#), satisfying experience of using hospital portals is closely related to factors such as usability, accessibility and trustworthiness of the provided information. Considering that medical tourism clients are at least less acquainted with the healthcare system of the countries they visit, it would be especially important to pay attention to the ease of use of the tools, the clarity of the information and their trust in the data security. [Akter et al. \(2013\)](#) provide evidence that mobile applications have made service delivery more transparent and reduced patient anxiety concerning new healthcare systems due to real-time communication possibilities here. Their findings are in line with the Technology Acceptance Model (TAM) proposed by [Davis \(1989\)](#), which defines perceived usefulness and perceived ease of use as two core determinants of technology acceptance.

2.4 Provider-Side Perspectives and Global Evidence

Evidence from outside India corroborates the general direction of these findings while also foregrounding provider-side costs. Patients who extensively used hospital platforms in Europe and Southeast Asia reported better care outcomes and faster recovery in some cases ([Gajarawala & Pelkowski, 2021](#)). [Brands et al. \(2022\)](#) write that digital technologies provide an opportunity for improving diagnostic accuracy, eliminating unnecessary clinical procedures, and enhancing collaboration within interdisciplinary medical teams. At the same time, these innovations create

difficulties for healthcare service providers in terms of interoperability of hospital information systems, cybersecurity issues, and the need to train their personnel ([Jain, 2023](#)). With the Indian medical tourism sector expected to share in the market that is growing and will reach over USD 142 billion by 2032 ([UNWTO, 2024](#)), the ability to preserve its digital edge will depend on successful tackling of these operational barriers not less than on the patient experience.

2.5 Research Gap

The literature establishes a possible and theoretically sound link between digital health instruments and patient experience, but there exists a distinct and less connected literature on the operational costs incurred by providers to deliver that experience. However, empirical research examining both sides of this connection is largely absent, especially within the narrower scope of the poorly researched population of international patients in India. This research fills that gap with the dual-respondent design which allows capturing two perspectives by obtaining providers' reports about the operational limitations facing them as well as patients' reports about their experiences directly.

3. Research Objectives

This study is guided by two complementary objectives:

1. To examine the impact of digital health portals and mobile applications on the experience and engagement of international medical tourists in India.
2. To identify the operational and technological barriers encountered by hospital IT managers in deploying and maintaining digital health portals for the international patient population.

4. Methodology

A quantitative, cross-sectional design was adopted to generate empirical evidence on the role of digital health portals and mobile applications in medical tourism, drawing simultaneously on the perspectives of users (medical tourists) and providers (hospital IT managers) at a single point in time.

4.1 Research Design, Population, and Sampling

The study population comprised two purposively selected stakeholder groups: (i) international medical tourists who had direct experience of an Indian hospital's digital platform, and (ii) hospital IT managers or administrators responsible for implementing and maintaining such platforms. A

total of 100 respondents participated in the study across both groups, recruited from accredited hospitals with an established international patient programme.

4.2 Data Collection Instrument

The collection of primary data will be facilitated by the use of a carefully constructed questionnaire that measures both the experiences of patients and views of health professionals through various sections that would provide material that is comparable yet understandable.

Questionnaire Structure

Section A: Demographic Characteristics

- Contains demographic details such as age, gender, country of origin (for patients), and job title (for staff from hospitals).

Section B: Use of Digital Instruments

- Involves the frequency of use of digital systems for various purposes by people (for example scheduling of appointments, video consultations, and access of health reports or follow-up phone calls).

Section C: Experience and Evaluation

- Utilizes five degrees of Likert scale (1 – Strongly Disagree; 5 – Strongly Agree), that involves the following features.
- Usability and Access: ease of navigation, Clarity of information, and compatibility of systems.
- Reliability and Trust: perceived security of data, stability of performance, and trust in digital communication.
- Quality of Information: properness, accuracy, and transparency of the medical information.
- Experience of Patients and their Involvement: total satisfaction with the service, responsiveness, and continuity of health.
- Barriers and Challenges (for Providers): various challenges like integration, compliance with privacy requirements, and IT infrastructure challenges.

4.3 Data Analysis

The collected quantitative data will be analyzed using appropriate statistical software SPSS.

Key analytical steps include:

- **Descriptive Statistics:** Calculation of means, standard deviations, and frequencies to summarize the patient satisfaction levels and operational challenge scores.
- **Inferential Statistics:** Techniques such as correlation analysis will be used to determine the statistical relationship between the measured variables (e.g., how the perceived usability of the app impacts overall patient satisfaction).
- **Comparative Analysis:** The innovative dual approach will allow for the correlation of patient-reported satisfaction scores with the provider-reported operational challenges, offering a holistic understanding of the socio-technical system's effectiveness and its limitations.

This robust, two-pronged methodology ensures that the research findings are comprehensive, evidence-based, and directly address the lacuna in the current academic literature, providing crucial actionable insights for all stakeholders in the medical tourism ecosystem.

5. Results and Analysis

This section presents the findings from 100 participants who were international medical tourists and hospital IT managers, which were organized according to the two objectives of this study: usability, reliability, and satisfaction from patient's perspectives and operational and technical difficulties provided from provider's perspective.

5.1 Objective 1: Patient Perceptions of Digital Health Portals

Dimension	Mean	SD	Interpretation
Usability (Q1–Q4)	3.49	1.09	Moderate ease of use; some interface challenges reported
Reliability (Q5–Q8)	3.41	1.11	Systems moderately stable; occasional downtime perceived
Information Quality (Q9–Q12)	3.62	1.08	Content perceived as accurate and informative
Patient Experience (Q13–Q17)	3.68	1.02	Strong satisfaction with experience and support

Dimension	Mean	SD	Interpretation
Overall Satisfaction (Q22)	3.74	1.01	Broadly positive satisfaction among medical tourists

Table 1. Descriptive Statistics of Patient Perceptions (Source: Author's compilation)

Mean satisfaction scores (Table 1) across all five dimensions fall in the moderate-to-high range ($M = 3.41\text{--}3.74$), indicating a generally favourable view of digital platforms among medical tourists. Notably, Patient Experience and Information Quality received the highest ratings, suggesting that respondents place greater weight on responsiveness, transparency, and perceived empathy than on the underlying technical performance of the platform.

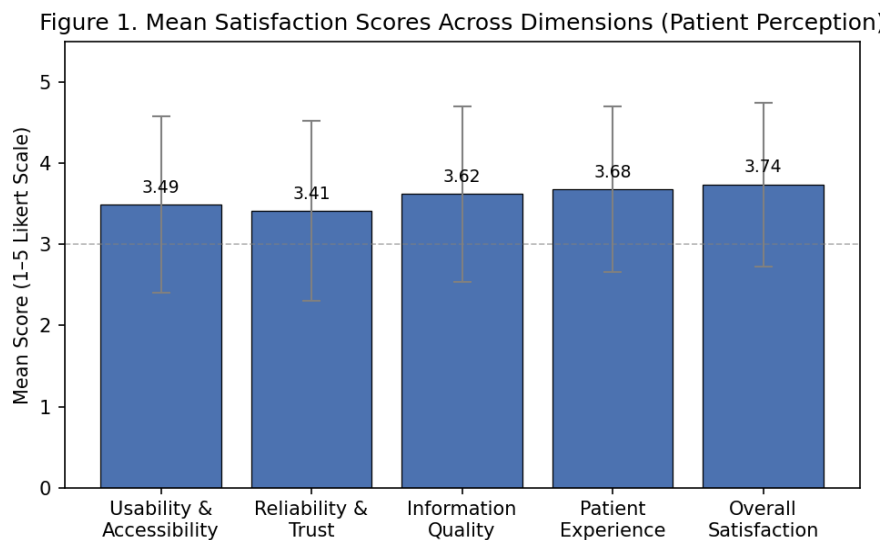


Figure 1. Mean Satisfaction Scores Across Dimensions (Patient Perception)

The pattern given in Figure 1 shows that the sample signifies gradual progression from Usability (average of 3.49) and Reliability (3.41) through Information Quality (3.62) and Patient Experience (3.68), to Overall Satisfaction (3.74); this was rated the highest. The trend shown in the figure indicates that the respondents give an answer that reflects some level of satisfaction with their digital experience. However, what they really want is proper improvements from a technological point of view.

5.2 Correlates of Overall Satisfaction

Variable	r with Overall Satisfaction	Interpretation
Usability	0.22	Weak positive relationship
Reliability	0.36	Moderate positive relationship
Information Quality	0.41	Moderate positive relationship
Patient Experience	0.52	Strong positive relationship
Operational Performance	0.45	Moderately strong relationship

Table 2. Correlates of Overall Satisfaction (Source: Author's compilation)

As indicated by Table 2, Patient Experience has the strongest correlation with overall satisfaction ($r = .52$), followed by Operational Performance ($r = .45$) and Information Quality ($r = .41$). Usability shows the lowest correlation (with $r = .22$). This means that using a website or application that is easy to use is not a good predictor of overall satisfaction; what counts more for medical tourists is interpersonal communication or service performance beyond the interface itself.

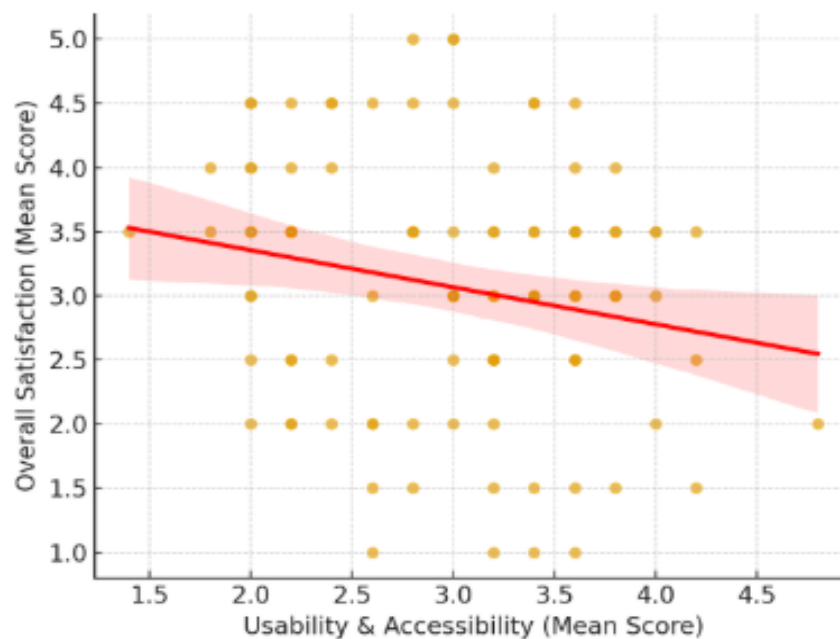


Figure 2. Usability and Overall Satisfaction, with Fitted Regression Line

The above Figure 2 plots overall satisfaction against usability with a fitted linear regression line, which slopes gently downward ($r = -.20$, $p = .043$). Read alongside the moderate usability rating in Table 1 ($M = 3.49$), this indicates that respondents who evaluate the interface most critically plausibly more digitally literate users with higher design expectations are not thereby less satisfied with their overall experience for reasons attributable to the interface itself, but rather because overall satisfaction is governed more by responsiveness, trust, and continuity of care than by interface usability alone. This is precisely the TAM-consistent pattern in which perceived usefulness, not raw ease of use, is the dominant driver of user satisfaction ([Davis, 1989](#)).

5.3 Objective 2: Provider Perspectives and Patient–Provider Comparison

Dimension	Patient Mean	Provider Mean	Observation
Usability	3.5	3.3	Providers report more backend usability issues
Reliability	3.4	3.1	Providers note technical disruptions more frequently
Information Quality	3.6	3.7	Both groups agree data is accurate and current
Patient Experience	3.7	3.8	Both perceive improved interaction and trust
Operational Performance	3.5	3.6	Functioning smoothly; workflow optimisation still possible

Table 3. Comparative Analysis of Patient and Provider Ratings (Source: Author's compilation)

Based on the comparative data (Table 3), patients have nearly the same opinion as healthcare professionals regarding Information Quality and Patient Experience with providers giving higher marks than patients establishing that the truth of digital communication is recognized on both ends of the spectrum. However, the situation changes regarding Usability and Reliability, which are evaluated lower regarding the views of providers as opposed to those of patients; this statement reflects the qualitative results showing that heads of IT departments in hospitals are facing different back-end problems associated with the integration of systems and some other issues. Moreover, providers listed interoperability issues in hospital systems, cybersecurity issues, and lack of personnel's training as the main barriers to employing hospital management systems; these

issues are in line with the aforementioned issues raised in Indian literature on hospital management systems ([Jain, 2023](#)).

6. Discussion

The research points out that digital health portals and mobile apps have come to play an increasingly important role in the journeys of medical tourists in India. Average satisfaction scores in all examined categories (3.41–3.74 on a five-point scale) suggest that digital solutions appear to be appreciated by patients despite the fact that there is still potential for improvement. The strong relationship between patients' ratings of overall satisfaction and patient experience ($r = .52$) as well as a moderately strong connection with operational efficiency ($r = .45$) suggests that interaction qualities of the digital experience – the ability to respond to patients, to generate trust, and to deliver continuity of care – are more important than purely technical matters such as interface or uptime of the platform.

This trend can be attributed to the Technology Acceptance Model ([Davis, 1989](#)) and its link with recent Indian research in the field of digital health technologies ([Medhekar, 2020](#)), both being keen on the value of usefulness and engagement as key to the longevity of acceptance of new technologies, rather than simplicity of usage. The observed moderate indices in terms of Usability ($M = 3.49$) and Reliability ($M = 3.41$) suggest that the users agree these platforms have their pros, although the issues they face while using these platforms (disruptions in the use of mobile applications, lack of access to the Internet and software glitches) may affect their willingness to use the tool in the future. This danger is particularly severe for medical tourists since they lack local alternatives and rely heavily on such platforms in their pre-arrival arrangements, management of in-country processes, and post-care follow-ups.

The gently negative usability–satisfaction slope shown in Figure 2, set against the positive correlation of usability with satisfaction reported in Table 2, is best read as a difference of analytic lens rather than a contradiction: Table 2 captures the direct association between the composite usability score and overall satisfaction across the full sample, while the fitted regression in Figure 2 shows that, at the level of individual responses, the most critical evaluators of the interface do not report proportionately lower overall satisfaction for reasons attributable to the interface itself. When combined together, these results show that more highly trained users expect more from an interface and can make finer distinctions when giving usability scores, important to note the phenomenon of self-selection in analogous digital health studies ([Carini et al., 2021](#)). It is clear

from both studies that satisfaction with digital health systems is a construct of multiple components such as technical, informational, and operational factors.

On their part, the providers' point of view shows that hospital IT managers experience their own set of pressures such as interoperability between older systems used at hospitals and the newer applications for patients, threat to cybersecurity caused by data transfers across borders, and training of employees that are needed for the process. Despite these burdens, providers converge with patients in rating Information Quality and Patient Experience favourably, suggesting that the platforms are, in practice, succeeding at their core function of supporting communication and continuity of care even where back-end operations remain strained. In summary, the outcomes indicate that India's transition to digital health in medical tourism has reached a point of functional maturity since there are functioning platforms already established in the market but has yet to attain a level of technical maturity where efficacy, dependability, and safety are assured. Bridging this gap will require continued investments in the design of user experiences, building the capability of personnel, and ensuring cybersecurity in addition to the policy framework already established under the aegis of the ABDM and Heal in India ([MoHFW, 2022](#)).

6.1 Limitations and Directions for Future Research

The results of the given research should be interpreted with caution as there are many limitations. First, limitations are based on the small sample size which decreases the accuracy and statistical power of correlations ($N = 100$). Second, it is worth mentioning that the cross-sectional design means that causation is not possible to infer. The third limitation is the use of self-reported data which may lead to social desirability bias. Further research should use larger sample sizes in different hospitals, longitudinal stage of the study to follow patients at all levels of their experience, and integrate quantitative data with qualitative interviews. Comparative studies on the performance of India in digital patient experience in comparison to competitors, such as Thailand and Singapore, would help understand the results of this study better.

7. Conclusion

This research presents clear proof that digital health platforms and mobile apps can significantly improve the experience of international patients in India by enhancing accessibility, transparency and continuity of care in ways that have become part of the healthcare and medical tourism infrastructure. Respondents provided favorable assessment of the experience in general, as Patient Experience and Information Quality got the highest mean scores showing that such factors as responsiveness, trust and accuracy matter more than technological aspect itself. Moreover, the fact

that Usability and Reliability received moderate ratings indicates that there is still a need to improve interface design and system stability. The strongest components of satisfaction were Patient Experience and Operational Performance, supporting the conclusion derived from the Technology Acceptance Model that perceived usefulness and engagement, but not ease of use plays the main role in the continuous use of digital health tools.

Having achieved both conclusions suggests that there is an imperative need for a focused strategic equilibrium between technological growth and the preparedness of the operations, and thus, advances in technology must make care delivery easier – not present new challenges. With continuing investments in the Ayushman Bharat Digital Mission and the Heal in India program, India possesses solid policy foundations for technology-led medical tourism; however, hospitals will have to keep working on optimising platforms, using effective data governance practices, and teaching patients and personnel about the system to maintain their competitive edge in a gradually digitising marketplace.

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