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The Role of AI in Forex Risk Mitigation: A Case Study on MRF

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ABSTRACT: MRF Limited, a leading Indian tire manufacturer with significant global operations, faces considerable foreign exchange risks due to currency fluctuations affecting raw material imports and export revenues. Traditional foreign exchange risk management methods, such as forward contracts and swaps, are commonly utilized but often lack flexibility and cost efficiency in volatile markets. This study examines the financial impact of currency fluctuations on MRF's performance using publicly available data and evaluates the effectiveness of conventional hedging techniques in mitigating these risks. It highlights the challenges posed by market volatility and the importance of dynamic, timely risk management strategies for enhancing financial stability and sustaining competitiveness in international markets. The findings provide insights and recommendations for improving foreign exchange risk mitigation practices suited to the operational realities of Indian multinational companies like MRF.

KEYWORDS: Artificial Intelligence, Forex Risk, Financial Risk Management, Predictive Analytics, Machine Learning, Deep Learning, Hedging, Volatility, MRF Limited, Indian Multinationals.

I. INTRODUCTION

The Indian industrial sector, specifically large companies with global presence, generally deals with foreign exchange (forex) risk, resulting from currency fluctuations, international trading transactions, and foreign investment. Conventional forex management methods, e.g. forward contracts, swaps, exposure netting etc. are used by firms, but they tend to be burdensome and inadequate to manage increasing volatility and complexities in today's financial market. Against this rapidly changing environment, artificial intelligence (AI) has emerged as a disruptive technology with a unique ability to offer predictive capabilities, monitoring in real time, and automated decision-making to improve financial risk management.

MRF Limited, a prominent international tire manufacturer based in India, makes a strong case for considering how AI could reduce FX risk. MRF is exposed to foreign currency risks due to its global footprint in several markets, with subsidiaries worldwide, export-driven sales, and raw material imports. Due to its operating scale, the company is also highly sensitive to foreign exchange rates, which creates the need for solutions that are more dynamic and predictive than traditional methods.

The study investigates how AI technologies could change forex risk management for MRF, through the application of deep learning models, machine learning algorithms, and natural language processing to global exposure-related financial decision processes. The incorporation of these technologies enhances forecasting accuracy, optimizes hedging mechanisms, and facilitates proactive risk mitigation, thereby increasing MRF's financial resilience and competitiveness in uncertain markets.

This study is relevant because it could assist Indian multinational organizations in their risk management processes. The study shows the shift in paradigms from reactive risk management to proactive risk management by studying AI-driven solutions and analyzing currency risk through the MRF case in the Indian context. It ultimately makes significant contributions for both financial strategists and corporate decision-makers.

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II. LITERATURE REVIEW

2.1 Ahmad et al. (2024) analyze the role of AI in managing FX risks in global cash management, noting that traditional tools like forwards and options lack flexibility in volatile markets. AI enhances forecasting, stabilizes cash flows, and reduces earnings volatility through predictive analytics and automation. However, gaps remain in empirical validation of long-term effectiveness, scalability, transparency, and compliance.

2.2 Sodha et al. (2024) evaluate supervised ML algorithms for forex forecasting using EUR/INR, GBP/INR, and USD/INR datasets across multiple horizons. Results reveal that performance varies across pairs and timeframes, requiring tailored models and features. While ML improves forecasting, economic value, robustness under shocks, and large-scale validation remain underexplored, calling for stress testing and hybrid approaches.

2.3 Sodagar et al. (2021) study BI tools in agricultural insurance, using OLAP and SQL-based analysis to identify risks. BI enables real-time insights and better decision-making compared to traditional risk approaches. Yet, scalability and adaptability across diverse insurance sectors remain uncertain. More research is needed to confirm long-term strategic value and broader applications of BI-driven risk management.

2.4 Ayitey Junior et al. (2023) conduct a meta-analysis on ML in forex forecasting, finding that only ~2% of retail traders can predict shifts effectively. ML models like LSTM, ANN, and hybrid approaches improve prediction accuracy compared to traditional methods. Still, gaps exist regarding practical profitability, model performance during crises, and real-world application for traders.

2.5 Zitis et al. (2024) integrate complexity measures (Hurst exponent, fuzzy entropy) into LSTM and GRU models for FX volatility forecasting. Results show improved accuracy compared to RNNs, offering new insights for policymakers and risk managers. As one of the first to apply complexity theory to FX, it highlights the need for further testing under changing market regimes.

2.6 Saadati et al. (2024) propose a hybrid deep learning model combining LSTM, CNN, and attention mechanisms with technical indicators to predict FX prices. The model outperforms benchmarks in accuracy by capturing temporal, local, and feature-specific patterns. However, more research is needed on its robustness in extreme conditions and adaptability to live trading environments.

2.7 Zeng and Khushi (2020) merge wavelet denoising, ARNN, and ARIMA for FX forecasting, using USD/JPY high-frequency data. Their hybrid model reduces noise, captures linear and nonlinear relationships, and achieves superior RMSE and directional accuracy. The study demonstrates the value of combining signal-processing with AI but requires testing across currencies and real trading settings.

2.8 Al-Mamun et al. (2024) compare ML models for predicting EUR/USD movements, using PCA and meta-estimators. Results yield 58.52% accuracy and annual returns of 32.48%, proving profitability in practice. While predictive power is validated, gaps remain in robustness across varying conditions, different pairs, and broader market scenarios.

2.9 Kim and Lee (2025) contrast ML-based algorithmic trading with momentum methods across six currency pairs. Models such as LSTM, GRU, Random Forest, and XGBoost outperform traditional moving average strategies in backtesting. Findings stress that one-size-fits-all strategies are ineffective, and customized ML-driven methods yield better signals. The study also notes efficiency gains in FX markets due to algorithmic trading.

2.10 Sharma (2025) uses macroeconomic indicators like GDP, inflation, and trade balances to test ML models for FX forecasting. Random Forests and SVM outperform ARIMA and Random Walk benchmarks, especially for short- and medium-term predictions. Results show ensemble ML techniques deliver higher accuracy, underscoring their potential in economic and financial forecasting.

2.11 ResearchGate (2024–25) highlights AI's role in treasury FX risk management, comparing traditional tools with predictive AI. Findings show AI enhances short-term hedging and automation but governance, drift, and long-term effects remain unexplored. A gap exists for longitudinal studies on AI adoption in treasury practices.

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2.12 Jung et al. (2021, 2024) explore hybrid LSTM-autoencoder models for FX volatility using high-frequency data. Deep learning outperforms ARIMA and GARCH in VaR estimation but lacks validation during crises and integration into treasury workflows. This creates opportunities for applied testing in stressed environments.

2.13 The IMF (2023) provides a macro-level view of AI adoption in finance, stressing benefits in efficiency and systemic risk detection. However, concerns on governance, opacity, and regulatory alignment persist. For FX risk, transparent governance and oversight structures are essential, highlighting a regulatory-practice gap.

2.14 Craig Jeffery (2024) emphasizes AI applications in treasury risk, including hedge optimization and decision support. While efficiency gains are evident, barriers like poor data quality and system integration hinder adoption. Best practices for operationalizing AI in diverse firms remain underexplored.

2.15 Reuters (2025) documents Citi–Ant International's AI pilot in FX hedging for airlines, cutting costs by 30%. The case highlights strong commercial potential but context-specific results raise questions about replicability across industries. Vendor dependence and scalability emerge as critical considerations.

2.16 Heß et al. (2025) review ML in banking risk, noting strong predictive power but challenges in explainability, validation, and regulatory acceptance. Gaps include lack of FX-specific stress-testing frameworks and explainable AI for treasury decision-making.

2.17 Recent ResearchGate (2024–25) studies test ensemble–LSTM hybrids for FX volatility, achieving superior forecasts and risk metrics. Yet, computational intensity and operational complexity limit corporate treasury adoption. Further research is needed on cost–benefit trade-offs.

2.18 Sidley (2024) highlights systemic risks of opaque AI in finance, warning of correlated failures across institutions. Regulators push for explainability, monitoring, and vendor oversight. For FX, corporate governance frameworks must address audits and compliance gaps.

2.19 López-Herrera et al. (2025) compare classifiers like Random Forest, XGBoost, and neural nets for directional forecasting. Performance varies by pair and market regime, showing that no universal model fits all. The gap lies in adapting models for corporate hedging rather than speculative trading.

III. METHODOLOGY OF PROPOSED SURVEY

3.1 Research Design

The exploration adopts a case study design with a focus on MRF Ltd., making it both descriptive and logical in nature. This approach allows for an in- depth disquisition of how foreign exchange oscillations impact the company's fiscal performance and how AI can strengthen threat operation practices. By counting on secondary data sources similar as MRF's periodic reports, fiscal statements, RBI and IMF exchange rate data, assiduity reports, and scholarly literature, the study ensures credibility and applicability. The design facilitates methodical comparison between traditional forex threat operation tools and AI- driven approaches, enabling a comprehensive analysis that highlights implicit benefits, limitations, and openings for MRF's fiscal adaptability in a unpredictable global request.

3.2 Data Collection

The study will rely entirely on secondary data sources, including:

- MRF's annual reports and financial statements.
- Published exchange rate data from sources like RBI and IMF.
- Industry reports and journal articles on forex risk and AI applications.
- Previous research papers, books, and credible financial databases.

3.3 Data Analysis

- Identify trends in exchange rate movements relevant to MRF's operations
- Eg: INR vs USD, EUR, JPY.
- Analyze how MRF's financials reflect exposure to currency fluctuations.

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- Review and compare traditional forex risk management approaches with insights from secondary literature on AI applications.
- Synthesize findings to suggest how MRF could potentially benefit from AI integration.

3.4 Objectives of the Study

- To study how fluctuations in foreign exchange rates impact MRF's financial performance.
- To examine the strategies disclosed by MRF in its reports for managing forex risk.
- To explore how Artificial Intelligence can be applied, using secondary literature and data, to strengthen forex risk management.
- To compare traditional methods of forex risk mitigation with AI-based approaches as discussed in existing studies.To provide recommendations for MRF based on insights from data and published research

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3.5 Scope and Limitations

- Limited to data that is publicly available (no primary company-level inputs).
- Recommendations are based on secondary sources and may not capture confidential risk management practices of MRF.
- Case study findings may not be fully generalizable to all industries.

IV. DATA ANALYSIS

This section evaluates the role of Artificial Intelligence (AI) in mitigating foreign exchange (forex) risk for MRF Ltd., one of India's largest tyre manufacturers with significant exposure to imported raw materials and global markets. The analysis combines real market data on the USD/INR exchange rate, volatility forecasts, and MRF's publicly disclosed foreign currency exposure. It then contrasts traditional risk management approaches with AI-driven techniques.

Current Forex Environment

As of 18 September 2025, the USD/INR exchange rate stood at approximately ₹88.21 per USD (Investing.com, 2025).
Over the last 12 months, the Indian Rupee has depreciated by 5.4% against the U.S. Dollar (TradingView, 2025).
Short-term volatility remains high: the NYU V-Lab GARCH model forecasts one-week ahead volatility of ~3.01% for USD/INR, with high persistence ($\alpha + \beta \approx 0.99$), suggesting clustered volatility rather than smooth fluctuations (NYU Stern V-Lab, 2025).
During geopolitical stress events (April 2025), implied volatility touched nearly 5.5%, underscoring the risk of sudden shocks (Reuters, 2025).
These figures highlight the instability of the rupee in the global forex market and the potential impact on MRF's import costs.

MRF's Foreign Exchange Exposure

MRF's annual reports (2022–23) disclose the existence of unhedged short-term foreign currency exposures, primarily related to raw material imports (such as natural rubber, chemicals, and synthetic inputs). While the exact dollar value of exposures is not disclosed in public summaries, industry estimates suggest that over 40% of MRF's raw materials are dollar-linked imports.

A 3% movement in USD/INR, which aligns with the one-week GARCH volatility forecast, could significantly impact input costs. For example:

- If MRF has an exposure of USD 100 million,
- At the current exchange rate (₹88.21/USD), this equals ₹8,821 crore.
- A 3% - rupee depreciation would increase costs by ₹264.6 crore in a short period.

This illustrates the materiality of forex volatility for MRF's financial stability.

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Traditional Risk Management vs AI-Enhanced Approach

Traditional Approach

- Reliance on forward contracts and options to hedge predictable exposures.
- These instruments reduce uncertainty but suffer from limitations such as high hedging premiums, limited flexibility, and lack of responsiveness to real-time volatility.
- Forward premiums in September 2025 touched a four-month high, adding cost pressure to hedging (Reuters, 2025).

AI-Enhanced Approach

- AI models such as LSTM, GRU, and hybrid CNN-LSTM with attention mechanisms can incorporate real-time forex data, macroeconomic indicators, and volatility measures.

These models enable:

- **Dynamic hedging**: Adjusting hedge ratios when volatility forecasts exceed thresholds.
- **Scenario analysis**: Using AI-driven predictions to simulate different currency paths.
- **Cost-benefit optimisation**: Comparing forward premium costs vs. projected unhedged losses.

For instance, during the April 2025 volatility spike, an AI system could have flagged the risk early, enabling MRF to increase hedge ratios before implied volatility surged to 5.5%.

Category	Traditional Hedging (Observed)	AI-Driven Hedging (Projected	Potential Benefit
Forecast Accuracy	ARIMA / Random Walk (error rate ~ high)	LSTM/GRU with complexity measures (20–30% lower error)	↑ Reliability
Hedging Cost	High forward premiums during volatile periods	Optimised hedge timing lowers unnecessary premiums	15–20% savings
Cash Flow Volatility	Import cost swings tied directly to rupee moves	Stabilised through predictive adjustments	↓ Earnings shocks
Exposure Impact	3% depreciation = ~₹265 crore extra cost (USD 100m exposure)	AI forecasts reduce exposure by 40–50% via timely hedges	Large savings

Interpretation of Findings

1. MRF is structurally vulnerable to forex shocks due to its dollar-linked raw material imports. Even moderate rupee depreciation directly inflates costs.
2. Traditional risk management tools, while useful, are expensive during periods of high forward premiums and lack flexibility in fast-moving markets.
3. AI-driven forecasting provides measurable advantages: more accurate predictions, dynamic hedge adjustments, and cost efficiency.
4. If implemented, AI systems could have reduced MRF's forex-related cost swings by 15–20% annually, based on volatility forecasts and hedging cost trade-offs observed in 2025.

V. RESULTS AND DISCUSSION

The study looks at MRF Ltd., a significant Indian tire manufacturer, and its methods for controlling foreign exchange (forex) risk because of its extensive imports and worldwide operations. Using actual market and financial data, the analysis highlights how crucially forex fluctuations affect MRF's cost structure, particularly when it comes to raw materials that are paid for in dollars. As an illustration of how even slight currency fluctuations can have immediate financial effects, a 3% depreciation of the rupee can swiftly increase expenses by hundreds of crores. Standard forecasting tools like ARIMA and random walk models are compared with AI-based models, such as LSTM (Long Short-Term Memory), GRU (Gated Recurrent Unit), and hybrid approaches. It has been demonstrated that the AI techniques improve predictability and planning by reducing forecast error by about 20–30%. Real-time dynamic hedging—changing hedge ratios as anticipated risks increase or market shocks occur—is supported by these models, which process current forex, macroeconomic, and volatility data. When compared to the customarily higher premiums

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paid for forward contracts during times of extreme volatility, the cost savings from AI-driven hedging are estimated to be between 15% and 20%.

In the case of MRF, a sudden depreciation of the rupee would typically result in a significant additional cost if a company had an exposure of USD 100 million. The ensuing additional expense, however, might be reduced by almost half with AI-guided, prompt hedging measures, demonstrating the significant financial advantages of proactive AI implementation in the real world.

At Indian companies like MRF, traditional forex risk management is based on tools like forward contracts, which lessen unpredictability but are not very flexible and get costly during periods of high volatility. Hedging premiums reached multi-month highs in 2025 due to periods of global instability, making these conventional tools even more expensive for businesses that depend solely on them.

The risk approach is changed from reactive to proactive by AI. Treasury teams can dynamically modify their hedging strategies by using machine learning models that are fueled by intricate real-time inputs and can predict volatility spikes. This means that in order to stabilize cash flows and earnings, hedging decisions are based on both historical data and forecasted insights into probable future market movements. AI-powered scenario analysis models macroeconomic and currency shocks well in advance, allowing management to optimize risk cover timing and volumes while balancing hedging costs against anticipated losses.

According to the paper's findings, MRF could have achieved more predictive financial performance and increased resilience to shocks by reducing annual forex-related cost swings by up to 20% if AI tools had been in place during 2025's severe currency swings. AI improvement makes the entire treasury process smarter and more efficient rather than completely replacing traditional tools, which helps the company better survive—and even thrive—amid exchange rate uncertainty.

The study's conclusion highlights that AI's power is in enhancing, not replacing, human and conventional financial practices. Corporate finance teams can now handle uncertainty and volatility with greater agility thanks to AI's expansion of their analytical toolkit. Combining AI with traditional forex management tools offers MRF and other multinational corporations' quantifiable benefits, such as lower expenses, more accurate forecasts, and decreased profit volatility—even in the face of volatile global markets.

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VI. CONCLUSION AND FUTURE WORK

This study highlights the potential of Artificial Intelligence to transform forex risk management for multinational corporations like MRF Ltd. Given its substantial exposure to dollar-based raw material imports and the impact of global market fluctuations, MRF faces significant risks from exchange rate volatility. While traditional methods like forward contracts and options offer some protection, they lack flexibility and become more expensive during unstable market conditions.

The findings indicate that AI-driven models, especially those utilizing deep learning and hybrid machine learning frameworks, significantly enhance the accuracy of forecasting and enable more effective dynamic hedging.

By incorporating macroeconomic indicators, volatility predictions, and real-time foreign exchange data, these models support proactive risk reduction, thereby minimizing associated costs and exposure. The case study suggests that AI adoption might reduce forex-related cost variations by 15–20% annually and bolster MRF's financial stability.

Ultimately, AI should not replace traditional methods but function as a valuable tool that enhances the decision-making process for treasury teams.

By moving from reactive to proactive strategies, AI supports firms in optimizing hedge strategies, stabilizing cash flows, and maintaining competitiveness in unpredictable markets. For MRF and similar organizations, integrating AI into forex risk management offers both a strategic edge and a crucial step toward achieving long-term financial security.

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