📊 Navigating the Future: A Deep Dive into the 90-Day Forecast & Technical Landscape of the KSE-100 Index

# Executive Summary

This report presents an extensive technical and statistical analysis of the KSE-100 Index, including a 90-day forecast using machine learning.   
We integrate momentum indicators, volatility trends, support/resistance levels, moving averages, and predictive modeling to equip investors, analysts, and financial planners with actionable insights.  
The core of this research lies in uncovering patterns, identifying predictive signals, and evaluating algorithmic strategy performance using historical index data.  
A random forest-based 90-day outlook suggests moderate upward momentum with controlled volatility. Additionally, technical indicators such as RSI, Bollinger Bands, and Moving Averages were employed to verify potential market signals.   
We also incorporated strategy simulations with and without stop-loss/take-profit to evaluate real-world trading potential.

# 1. Data Cleaning & Normality Check

- Missing and invalid values were removed.

- The 'Current' column was converted to numeric and normalized.

- Shapiro-Wilk test indicated non-normal distribution (p = 0.0000).

- Implication: Tree-based or non-parametric models are more suitable.

- Limitation: Classic parametric tests (t-test, etc.) are not valid.

# 2. Time Series Visualization

- Historical and forecast data plotted (June 2024 - July 2025).

- Strong upward trend with minor volatility.

- Peak index values around 120,000 suggest bullish sentiment.

* Implication:

Encouraging signal for long-term investors.

* + Limitation:

May not capture geopolitical or macroeconomic shifts.

# 3. Moving Averages Analysis

- MA(3) and MA(20) computed.

- Short-term crossover above long-term → bullish.

- Long stretches of convergence → consolidation.

* Implication:

Confirms momentum and short-term shifts.

* Limitation:

Moving averages are lagging indicators.

# 4. Peaks and Troughs Identification

- Local extrema help identify price exhaustion or support zones.

- Detected via `find\_peaks` with spacing of 5 periods.

- Suggests swing trade potential.

* Limitation:

Not forward-looking; susceptible to noise.

# 5. Pivot, Resistance, and Support Levels

* Pivot = 107,146; Resistance up to 154,414; Support down to 59,878.

- Visualized alongside index trend.

* Implication:

Key price zones for decision-making.

* + Limitation:

Static thresholds that evolve slowly in dynamic markets.

# 6. Volatility Insight

- Measured via 10-day rolling standard deviation.

- Increased volatility seen during rallies and corrections.

* + Implication:

Assists in risk-based sizing and timing.

* + Limitation:

Historical; doesn't predict future shocks.

# 7. Technical Indicators: RSI, Bollinger Bands

- RSI (14-day): Overbought (>70) and Oversold (<30) signals.

- Bollinger Bands: Mean reversion and volatility measure.

- Combined with crossover signals (SMA vs EMA).

* Implication:

Multiple validation signals for trend shifts.

* + Limitation:

Can generate false signals in strong trends.

# 8. Strategy Backtest

- Buy: RSI < 30 & rebound from lower band.

- Sell: RSI > 70 or cross below upper band.

- Strategy with Stop-Loss/Take-Profit outperformed others.

* + Implication:

Active management enhances profitability.

* + Limitation:

Does not consider transaction fees or slippage.

# 9. Machine Learning Forecast (Random Forest)

- Trained on lag features and date components.

- Forecast shows cyclical growth and stability.

- Confidence intervals show controlled risk.

- Peaks and troughs identified to anticipate reversals.

* + Limitation:

Does not account for policy or macro shifts.

# 10. Model Evaluation

- Mean Squared Error (MSE): ~3.57 million.

- Visual comparison showed minimal bias or variance.

* + Implication:

Reliable short-term predictions.

* + Limitation: Accuracy depends on stability of training data.

# 11. Gradio Interface for Interactive Use

- CSV input for live forecasting with pivot, support/resistance, volatility overlays.

- Non-technical users can simulate scenarios interactively.

- Limitation: Model switching (e.g., to LSTM) not yet supported.

# 12. Conclusion and Recommendation

- The KSE-100 index shows strong momentum with brief corrections.

- Forecast tools provide consistent, explainable insights.

* + Recommend:

Use combined strategy (momentum + mean reversion + SL/TP).

* + Future work:

Include macro indicators and alternative models like LSTM or hybrid ensembles.