# Time Series Sales Forecast - Stakeholder Report

## 1. Executive Summary

We analyzed 5 years of monthly sales data (Jan 2018 - Dec 2022) and compared two forecasting approaches: ARIMA and Prophet. Prophet demonstrated higher accuracy on the 6-month backtest window (MAPE ~ 6.4% vs 10.2% for ARIMA), capturing seasonal dips and peaks more effectively. The near-term outlook indicates steady sales in the low-to-mid 14,000s per month. This report translates these results into clear, actionable recommendations for inventory, marketing, staffing, and finance planning.

## 2. Key Patterns & Trends

- Consistent year-end strength and mid-year softness indicate predictable seasonality.

- Steady underlying growth trend over the five-year period.

- Moderate volatility, with actuals ranging from ~3,900 to ~16,000 per month.

## 3. Model Comparison & Accuracy

Prophet: MAPE ~ 6.4%, MAE ~ 895, RMSE ~ 1,026 — best at capturing month-to-month variations.  
ARIMA(1,1,1): MAPE ~ 10.2%, MAE ~ 1,322, RMSE ~ 1,594 — flatter month-to-month forecast.  
Recommendation: Use Prophet as the primary model for planning, with ARIMA as a benchmark.

## 4. Forecast Results - Next Quarter (Planning Baseline)

Until exact Prophet next-quarter forecast values are provided, we use a conservative baseline of 14,000 per month, applying a ±6.4% error band and a +10% upside scenario.

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| --- | --- | --- | --- | --- |
| Month | Lower (-6.4%) | Base | Upper (+6.4%) | +10% Scenario |
| Jan 2023 | 13,104 | 14,000 | 14,896 | 15,400 |
| Feb 2023 | 13,104 | 14,000 | 14,896 | 15,400 |
| Mar 2023 | 13,104 | 14,000 | 14,896 | 15,400 |

## 5. Scenario Planning

- Upside (+10%): Secure flexible supplier agreements and prepare surge staffing to meet demand without quality drop.  
- Downside (-10%): Use this to stress test cash flow and adjust promotional strategies accordingly.

## 6. Business Implications

- Inventory: Stock according to base forecast, with safety stock toward upper bound if needed.

- Marketing: Increase campaigns before peak months and use promotions during slow periods.

- Operations: Align staffing schedules with demand peaks to meet service targets.

- Finance: Use forecast range to set targets and budgets with risk buffers.

## 7. Recommended Next Steps

- Integrate Prophet forecast into dashboards and monitor monthly performance.

- Update model monthly with new data and run quarterly backtests.

- Include campaign, pricing, and holiday variables in Prophet to improve accuracy.

## 8. Appendix - Methodology (Concise)

Data: 60 monthly records (2018-2022). Training set: up to Jun 2022; Test set: Jul-Dec 2022.  
Models: ARIMA(1,1,1) and Prophet with yearly seasonality.  
Evaluation: MAE, RMSE, MAPE. Scenario planning included a +10% uplift for upside cases.