Sales Forecasting of Air Conditioner Cleaning Services by Sales Channel of Home Product Center Public Company Limited Using the Box–Jenkins Method

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Abstract

This study aims to develop forecasting models and forecast sales of air conditioner cleaning services across three sales channels—Mobile App, Website, and Branch—using the Box–Jenkins method. Secondary data were obtained from Home Product Center Public Company Limited. Monthly time series data were collected from September 2020 to June 2025 for the Mobile App channel, and from January 2020 to June 2025 for the Website and Branch channels. The data were divided into training and testing sets. For the Mobile App channel, the training period covered September 2020 to June 2024, and the testing period covered July 2024 to June 2025. For the Website and Branch channels, the training period covered January 2020 to May 2024, and the testing period covered June 2024 to June 2025. Forecasting accuracy was evaluated using Mean Absolute Percentage Error (MAPE). The results show that the ARIMA(0,1,0) model was selected for both the Mobile App channel (MAPE = 21.34%) and Website channel (MAPE = 33.45%). however, diagnostic checking indicated that these models were not suitable for forecasting. For the Branch channel, the SARIMA$(0,1,0)(1,0,0)_{12}$ model was selected (MAPE = 28.65%), and diagnostic results confirmed that this model was appropriate for forecasting.

Introduction

Thailand's hot and humid climate makes air conditioners essential in households and businesses, leading to a continuous increase in demand for air conditioner cleaning services, especially in urban areas. As a result, effective resource planning—such as technician allocation, equipment management, and promotional strategies—is crucial to meet fluctuating demand.

Objective

1. To develop a forecasting model for air conditioner cleaning service sales across the three sales channels: Mobile App, Website, and Branch stores.
2. To forecast air conditioner cleaning service sales across the three sales channels: Mobile App, Website, and Branch stores.

Data Preparation

Monthly Sales of Air Conditioner Cleaning Services

- Mobile App → September 2020 to June 2025 (58 months)
  - Training Data: September 2020 to June 2024 (46 months)
  - Testing Data: July 2024 to June 2025 (12 months)
- Website, Branch stores → January 2020 to June 2025 (66 months)
  - Training Data: January 2020 to May 2024 (53 months)
  - Testing Data: June 2024 to June 2025 (13 months)

Time Series Analysis

- Trend and Seasonality Analysis
  - Trend Analysis → Run Test
  - Seasonality Analysis → Kruskal-Wallis Test
- Stationarity Testing
  - Stationary → Augmented Dickey–Fuller Test (ADF Test)

Model Validation

Residuals

- Normal distributed → Kolmogorov-Smirnov
- Mean is zero → t-Test
- Homoscedasticity → Levene's Test
- Autocorrelation → Ljung-Box Test

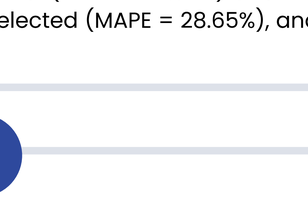
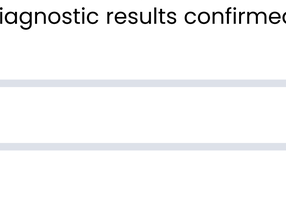
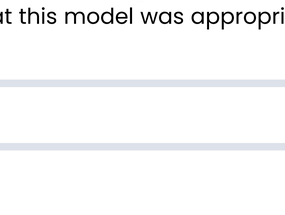
Methodology

Data Preparation → Time Series Analysis → Forecasting Model → Model Validation → Forecasting

Forecasting Model

The model was estimated using the auto.arima() function in R.

Result & Conclusion

	Mobile App	Website	Branch stores
Training Data			
Trend	✓	✓	✓
Seasonality	✗	✗	✓
Stationary	✓	✓	✓
Forecasting Model	ARIMA(0,1,0)	ARIMA(0,1,0)	SARIMA$(0,1,0)(1,0,0)_{12}$
MAPE (%)	21.34	33.45	28.65
Normal distributed	✓	✓	✓
Mean is zero	✓	✓	✓
Homoscedasticity	✓	✓	✓
Autocorrelation	✗	✗	✓
Appropriate forecasting model	✗	✗	✓
Forecasted Sales (Baht)	–	–	

Recommendations

1. The two forecasting models were unsuitable; therefore, data transformation such as square root or the Box–Cox Transformation is recommended.
2. Future studies should consider other forecasting methods, such as decomposition or smoothing techniques.

References

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