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Cost Forecasting of Construction Materials: In India

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Abstract – *In India the demand of construction sector is increasing day by day. Within 20 years we can expect a growth of 30% in the construction sector in India. The major reason for it may be the increased population and demand for industrial spaces. Now in India the Construction Cost Index (CCI) are widely used to forecast the construction costs. This research aims to forecast the construction material prices directly using ARIMA modeling followed by an Expert survey. So, it will be very beneficial for construction stakeholders, project owners, Engineers etc.*

Key Words: ARIMA, Cement, Steel, Brick, M sand.

1.INTRODUCTION

Cost management is an important aspect in construction project management. Recently the construction material prices are subjected to large type of fluctuations depending on different factors. If the construction stake holders, project owners, contractors and engineers get an estimate regarding the future building material prices, it may be very beneficial for them in preparing future budgets. The modeling is done using IBM SPSS Statistics.

1.1 ARIMA Modeling

ARIMA (Auto Regressive Integrated Moving Average) method is an efficient time series analysis method especially used for forecasting univariate time series data. This method is an integration of Auto Regression model and Moving Average model. This modeling method has been selected based on the advice from the experts.

1.2 Expert Survey

An expert survey has been conducted to determine the future prices of building materials and the underlying causes. The survey was conducted all over India among the manufacturers, suppliers, cost analysts, purchase managers, project managers etc. The sample size is determined based on Cochran's formula.

2. RESEARCH METHODOLOGY

Different approaches have been analyzed to determine the best fitting model for forecasting construction costs. ARIMA modeling was selected based on the advice from the experts. And an expert survey also conducted and finally the results are compared.

2.1 Auto Regressive Integrated Moving Average method

ARIMA (Auto Regressive Integrated Moving Average) method is an integration of Auto Regression model and Moving Average model. ARIMA model is represented as ARIMA (p, d, q). p represents number of auto regressive terms. q is the number of moving average terms. d is the order of differentiation to make the non-stationary series stationary. For modeling the historical data regarding material prices for past 15 years has been utilized. For cement, it was found that ARIMA (1,1,1) is the best fitting model and forecasting has been done with this model. Best ARIMA model is identified using following table.

Table 1: Criteria for best ARIMA model

Model fit statistic	Remarks
R-squared	Should be close to 1
RMSE (Root Mean Squared Error)	Lowest value indicates good model fit
MAPE (Mean Absolute Percentage Error)	Lowest value indicates good model fit
Normalized BIC	Least is the best
Model significance (P-Value) Ljung BOX	Greater than 0.05 to accept HO: residuals are white noise

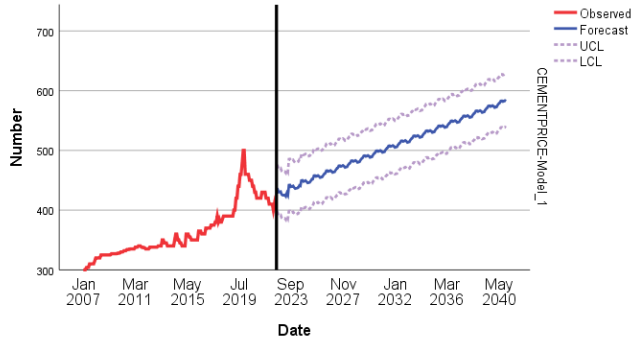

Figure 1: ARIMA model (1,1,1): Cement

For the steel it was found that ARIMA (1,1,0) is the best fitting model and further forecasting has been done with it. The q and p values are found from Autocorrelation function graph and Partial Auto correlation function graph

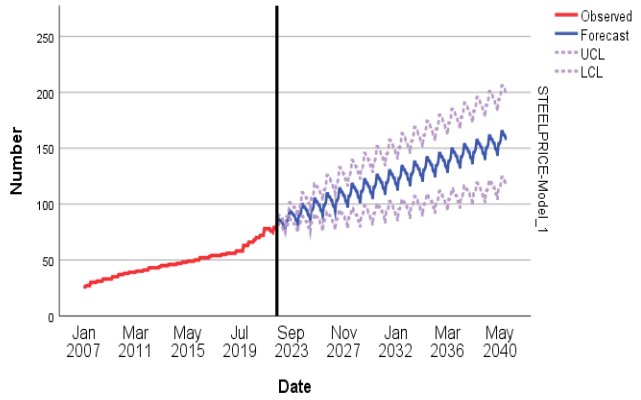

Figure 2: ARIMA model: Steel

For the Solid brick it was found that ARIMA (1,1,1) is the best fitting model and further forecasting has been done with it.

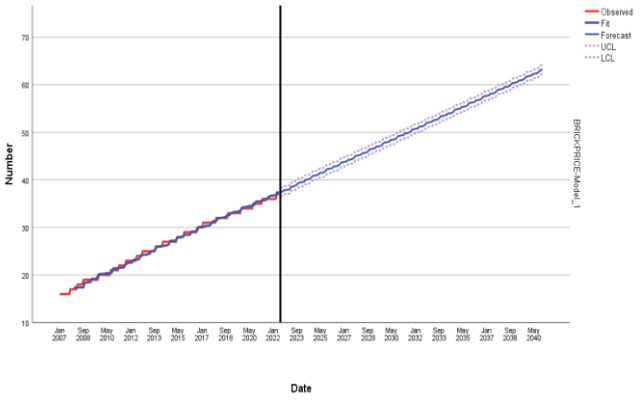

Figure 3: ARIMA model (1,1,1): Solid brick

For the M sand it was found that ARIMA (1,1,0) and ARIMA (1,1,1) is the best fitting model and further forecasting has been done with it.

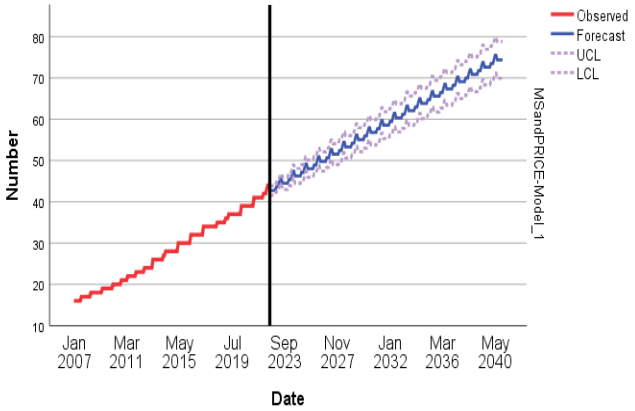

Figure 4: ARIMA model (1,1,0): M sand

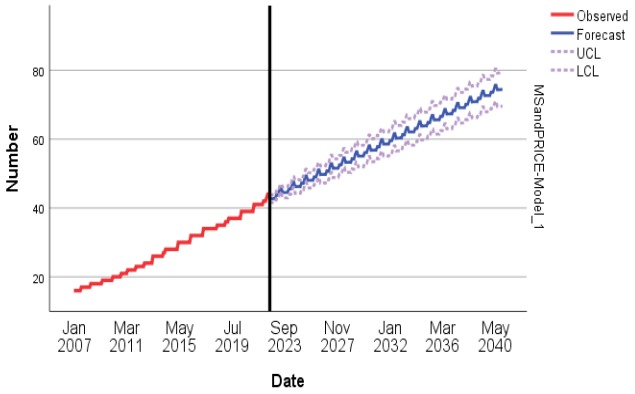

Figure 5: ARIMA model (1,1,1): M sand

2.2 Expert Survey

An expert survey has been conducted among 140 experts all over India. The sample size is determined based on Cochran's formula. The reliability statistics obtained was 0.85(relatively good). The finding from the survey are as follows.

In the coming 20 years in India, we can expect a growth in construction sector between 10-30% compared to today. The major reason for it was found is increased population. The Cement price can increase between 30-50% in coming 20 years and steel price will rise above 75% in India, because of the lack of availability of raw materials. The brick price may rise between 50-75% and in the case of M sand also price hike of 50-75% can be expected within 2040.The major reasons for M sand and Brick was found as the increase in supply and demand.

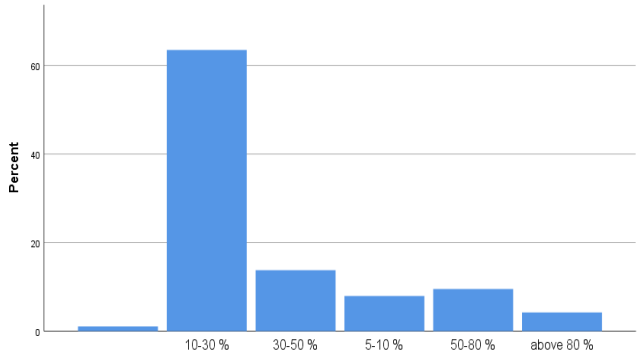

Figure 6: Percentage demand increase in construction sector in India

3.CONCLUSIONS

From the Modeling and survey, the results obtained has a very good match between them. The cost of TMT steel bars can double over the next 20 years compared to today. Price and availability of raw materials and increased supply and demand may be the major reason for price hike of building materials in future.

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