Forecasting Analysis for an Auto Parts Manufacturer using Least Inaccuracy Cost Criteria

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ABSTRACT

Although forecasting resembles fortune telling, businesses plan and execute all plans based on informal or formal forecasts about the demand for their products and services. In this study, we will present a summary of the forecasting analysis project that we conducted in an automobile parts manufacturer in the mid-west for seven of their critical products. For each product, several forecasting models were evaluated on a four-year monthly data. However, instead of focusing on the standard error measures such as Mean Square Error and Mean Absolute Deviation, we developed a unique criteria based on least cost to measure the ``most desirable" forecasting model. The results of this process will be discussed for example products.

Objective

The Famous business promoter, Elbert Hubbard, once said, ``*Progress comes from the intelligent use of experience*" (*Thoughts* 115). We were set on the endeavor of finding and attaining peak progress through studying previous demand forecasts of seven critical Hanger and Attaching Part Kits (HAPs), and finding the most desirable forecasting model which would also reflect the lowest dollar cost for the company.

Methodology

Our client, whom for the purposes of confidentiality we will refer to as Crown Corp., provided the demands of their seven critical HAPs over the past four years on a monthly basis. We then ran twenty-six different forecasting models on each of the products. These forecasting models were obtained from the Production Operations Management software (POM), and then entered on an Excel database for further manipulations. The forecasting models used were:

Weighted moving averages 3 periods.
Exponential Smoothing. alpha .2
Exponential Smoothing. alpha .4
Exponential Smoothing. alpha .6
Exponential Smoothing. alpha .8
Exponential Smoothing. alpha 1
Exponential Smoothing with trend. alpha .2 beta .25
Exponential Smoothing with trend. alpha .4 beta .25
Exponential Smoothing with trend. alpha .6 beta .25
Exponential Smoothing with trend. alpha .8 beta .25

Exponential Smoothing with trend. alpha 1 beta .25
Exponential Smoothing with trend. alpha .2 beta .5
Exponential Smoothing with trend. alpha .4 beta .5
Exponential Smoothing with trend. alpha .6 beta .5
Exponential Smoothing with trend. alpha .8 beta .5
Exponential Smoothing with trend. alpha 1 beta .5
Exponential Smoothing with trend. alpha .2 beta .75
Exponential Smoothing with trend. alpha .4 beta .75
Exponential Smoothing with trend. alpha .6 beta .75
Exponential Smoothing with trend. alpha .8 beta .75
Exponential Smoothing with trend. alpha 1 beta .75
Decomposition (seasonal) 4 seasons.
Decomposition (seasonal) 3 seasons.
Decomposition (seasonal) 2 seasons.
Trend Analysis (regress over time).
Linear regression (least square).

Typically, these forecasting models reflect the standard error measures such as Mean Square Error and Mean Absolute Deviation.

The company supplied us with both the shortage and carrying costs, typically 10% and 20% respectively of the cost of the product, at the onset of our empirical endeavor. Our next step was to compare the error of our forecasting models, with the respective demand of each period. The stipulation was simple; if we obtained a negative integer for our error, (i.e. the forecast was less than the actual demand) then we proceeded by multiplying the absolute value of our error with our shortage cost. In the case of getting a positive integer for our error (indicating that more of the product was produced than necessary), then we multiplied the absolute value of our error with the carrying cost of our product.

Example

HAP 201-00
Carrying cost (i.e. the cost of storing one piece of the product in company inventory) $15.60

Shortage cost (i.e. the cost of having fewer products than actually demanded) $31.20

April 1995's Demand for HAP 201-00 was 41 pieces

Exponential Smoothing with alpha value at 1 forecasted that we needed 96 pieces

This resolved in having 55 extra pieces in inventory.
We proceeded in multiplying the 55 extra pieces by the carrying cost in order to get a $ value.
55*$31.20= $1,716

Findings

Product	Highest Cost	Forecasting Model	Lowest Cost	Forecasting Model	$ Difference
		Exponential Smoothing		Regression	

HAP103-00	$47,908.07	with trend α 1 β .75	$4890.93	Least Square & Trend analysis Over Time	$43,017.14
HAP105-00	$14,170.00	Exponential Smoothing α 1	$5,388.04	Decomposition 3 Seasons	$122.98
HAP105-01	$151.92	Exponential Smoothing with trend α 1 β .75	$28.94	Exponential Smoothing α .2	$122.98
HAP106-00	$1,749.65	Exponential Smoothing with trend α 1 β .75	$928.53	Weighted Moving Averages	$821.12
HAP156-00	$31,447.44	Exponential Smoothing with trend α 1 β .75	$6,058.39	Exponential Smoothing with trend α .2 β .75	$25,389.05
HAP201-00	$40,641.63	Exponential Smoothing with trend α 1 β .75	$18,056.81	Decomposition 2 Seasons	$22,584.82
HAP206-01	$2,492.97	Exponential Smoothing with trend α 1 β .75	$953.55	Exponential Smoothing α .6	$1,539.42
TOTAL SAVING					$102,256.49

Table 1. Total savings is the summation of the differences between the highest and lowest $ costs for all the products.

Conclusion

For every product there is a forecasting method, which although might not be the most accurate in terms of least error, reaps the most cost efficient prediction in terms of Dollar amount.

We have embarked on a simple method of forecasting that proved to be an efficient one in terms of cost. Again, it must be mentioned that previous production forecasts were ones that focused on standard error measures such as Mean Square Error and Mean Absolute Deviation. We, however, have successfully developed a unique criteria based on least cost to measure the ``most desirable'' forecasting model for production. Through this study we merely substantiated common sense with hard facts and figures.

We managed to save $102,256.49 for Crown Corp. (through only seven of their products) by our least inaccuracy cost criteria. We recommend that the company would run similar tests for all their future production forecasts, using a different array of forecasting models, and considering the product's carrying and shortage costs.

REFERENCES

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Rami is scheduled to graduate in May 2000 with a degree in Marketing and Advertising. He was born and raised in Kuwait and then lived in his home country Egypt for three years before pursuing his college education in the United States. His research was presented at the 2000 IUSB Undergraduate Research Conference.