INSTANT CEMENT FORMING USING HOLT-WINTER (CASE STUDY: CV TRIJAYA ABADI)

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ABSTRACT

CV.Trijaya Abadi is an industry that produces cement, and make various innovations by producing instant cement. It is often the case with errors in doing the forecasting is if the amount of production is produced too much while the demand is small it will cause losses for the company as well as vice versa if the demand a lot while the production will be a bit disappointment of consumers resulting in the company losing konsakuya. know the amount of instant cement production in the next period. The method used for forecasting in this research is Exponential Smoothing Holt-Winters method with multiplyative seasonal method and additive seasonal method. The alpha, beta and gamma values used are 0.9, 0.1, and 0.1. With the value of these parameters are able to produce the value of MSE amounting to 52347.63 and MAPE value of 6,649 is forecasting in 2016 for multiplyative seasonal method. For additive seasonal method, the value of MSE is 50560.88 and MAPE value of 6,619 forecasting in 2016. So it is concluded that it is more accurate to use the Holt-Winters additive seasonal method in 2016 forecasting of instant cement.

Keywords: *Production of light brick, exponential smoothing holt-winter, MSE, MAPE, seasonal multiplication, seasonal addition.*

1. INTRODUCTION

Cement is one of the most important materials in a building and house construction. The more development, the more demand to produce cement on a large scale. In 2015 kemenperin mention cement production mencapai 8 ton. Salah satu perusahaan semen yang ada di Indonesia adalah PT Suko Mitra Sejati. PT Suko Mitra Sejati adalah sebuah perusahaan yang bergerak di bidang konstruksi yang menawarkan berbagai produk dan kemampuan proyek, memiliki semua sumber daya yang tepat untuk eksekusi baik paket skid-mount untuk minyak dan gas, petrochemical, construction, and mining industries. CV Trijaya Abadi is a subsidiary of PT Suko Mitra Sejati which produces building materials.

In an effort to maintain the predicate as cement producer CV Trijaya Abadi continue to make various innovations. One such innovation is to produce instant cement. This instant cement made from lime, CaCO3, sand, and lime powder serves to fill the gaps or pores that arise from a mixture of porcelain and sand materials. But the problem that often happens is the lack of measure in determining the amount of instant cement produced because in addition to the new cement instant is also still not widely known in the community, so it can not forecast the number of cement demand. It is often the case with errors in the forecasting is when the amount of production is produced too much while the demand a little it will cause losses for the company as well as vice versa if the demand a lot while the production will be a bit disappointment of consumers causing the company loses kons.

2. RESEARCH METHODOLOGY

This research is divided into 5 stages, namely requirement analysis, system design, Implementation, Test system, Care, Report writing.

1. Needs analysis
   At this stage the authors do data collection by taking the CV Trijaya Abadi. From the process Data that have been obtained will be analyzed.
2. System design
   The authors in this phase do the design of desaign system using Data Flow Diagram and Flowchart System.
3. Implementation
   At this stage the authors perform data translation or problem solving that has been designed into programming languages. The programming language used is PHP with Codeigniter Framework and MYSQL database storage.
4. Test the system
   This stage of the authors perform tests conducted using Mean square error testing and Mean absolute procentage error to see the error rate.
5. Treatment
   In this stage the authors do Maintenance is done if there are new variables are added so that will be made changes to the system.
6. Report writing
   This stage the authors make a report from the introduction to the cover.

3. DESIGNING

In the process of instant cement production in CV. Trijaya Abadi at this time, the determination of production amount is still manual and still based on consumer demand and order estimation. The more development, the more demand to produce cement on a large scale. But the problem that often happens is the lack of size in determining the amount of instant cement produced because in addition to the new cement is also still not widely known in the community. The problem is raised by the author in the Final Project, where the authors want to create an application that can predict the production of instant cement so that it can reduce errors in the production. This instant cement production data is data taken from CV company. Trijaya Abadi which is used as a guide in doing forecasting. The first step is to initialize alpha, beta, gamma then do the calculation to find the initial value of SL and bL that will be used for the smoothing process. For more details can be seen in Figure 3.1 below.

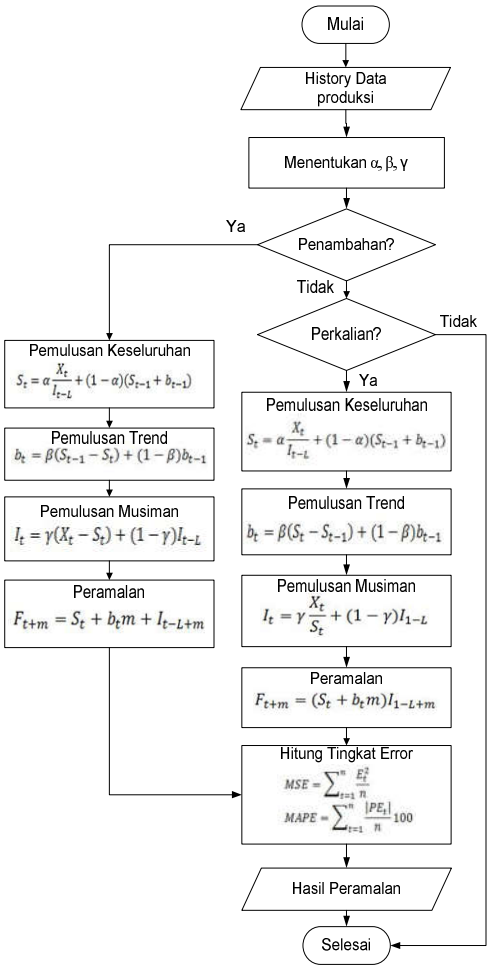

Figure 3.1 Flowchart method Exponential Smoothing holt-winter

In Figure 3.1 this explains the flow of the exponential smoothing holt-winters method. From input production data, then initialization parameters α, β, and Ϫ. Followed by holt-winter calculations with seasonal multiplication components as well as seasonal additions. Calculation of error rate using MSE and MAPE, to obtain the results of forecasting in the period to come.

1.1 Exponential Smoothing Holt-Winter Seasonal Multiplication

Holt-Winters Exponential Smoothing Method with Multiplicative Seasonal Methods used for seasonal variation of data that increases / decreases (fluctuations) by formulas

Whole smoothing

$$S_t = \alpha \frac{X_t}{I_{t-L}} + (1-\alpha)(S_{t-1} + b_{t-1}) \quad (3.1)$$

Trend Slicing

$$b_t = \beta(S_t - S_{t-1}) + (1-\beta)b_{t-1} \quad (3.2)$$

Seasonal Smoothing

$$I_t = \gamma \frac{X_t}{S_t} + (1-\gamma)I_{1-L} \quad (3.3)$$

Forecast

$F_{t+m} = (S_t + b_t m) I_{1-L+m}$ *(3.4)*

1.2 Exponential Smoothing Holt-Winter Seasonal Additions

Holt-Winters Exponential Smoothing Method with Additive Seasonal Methods used for seasonal variations of a constant nature with formulas

Overall Smoothing

$S_t = \alpha(X_t - I_{1-L}) + (1-\alpha)(S_{t-1} + b_{t-1})$

(3.5)

Trend Slicing

$b_t = \beta(S_{t-1} - S_t) + (1-\beta) b_{t-1}$ (3.6)

Seasonal Smoothing

$I_t = \gamma(X_t - S_t) + (1-\gamma) I_{t-L}$ (3.7)

Forecast

$F_{t+m} = S_t + b_t m + I_{t-L+m}$ (3.8)

The meanings of symbols used in equations (3.1) to (3.8) are:
Xt = the actual value in the final period t
α = smoothing constants for data (0 <α <1)
β = refinement constant for trend (0 <β <1)
γ = the smoothing constants for seasonal (0 <γ <1)
St = initial smoothing value
bt = smoothing constant
I = seasonal adjustment factor
L = long season
Ft + m = forecast for future period m of t

1.3 MSE and MAPE

Mean Squared Error (MSE)

$$\text{MSE} = \sum_{t=1}^{n} \frac{e_t^2}{n} \text{ (3.9)}$$

Mean Absolute Percentage Error (MAPE)

$$\text{MAPE} = \sum_{t=1}^{n} \frac{|PE_t|}{n} \text{ (3.10)}$$

The meaning of symbols used in equations (3.9) and (3.10) are:
PEt = percentage error = x 100
Et = error period t = Xt - Ft
Xt = actual data of period t
n = many periods t.

4. RESULT AND DISCUSSION

The experiments carried out were to process the calculation of forecasting in 2011, 2012, 2013, 2014, and 2015 by using multiplication and incremental components by randomizing the alpha, beta and gamma values, the smallest MSE and MAPE values later that will be used for forecasting. After the experiment proses perhitungan peramalan menggunakan komponen perkalian dan sum with alpha value = 0.9, beta = 0.1 and gamma = 0.1. by searching for multiplicative and additive forecasting results to find out which smaller value of the resulting error difference.

From table 4.1 we get the results of Comparison of HoltWinters Components of Addition and Multiplication Seasonal using the difference of error value on thinbed product in 2016.

Multiplicative		Additive	
Forecast	Difference	Forecast	Difference
2977.68	781.32	2977.64	781.36
2881.98	427.02	2899.02	409.98
2857.74	1515.26	2878.85	1494.15
2984.76	720.76	2981.45	717.45
3218.60	894.60	3171.57	847.57
3170.95	999.95	3133.12	962.12
2385.32	1560.68	2492.48	1453.52
2202.73	1125.27	2344.34	983.66
2807.90	1159.10	2831.30	1135.70
3343.12	382.12	3259.51	298.51
3415.55	47.45	3317.98	145.02
3214.95	54.95	3160.52	0.52

Figure 4.1 Comparison of Thinbed Products with Addition Components and 2016 Seasonal Concessions

5. CONCLUSION

The conclusion that can be drawn from the design of production forecasting application using exponential smoothing method of Holt-Winter is:

1. Implementation of built systems has been through a trial process that produces forecasting of instant cement production in CV. Trijaya Abadi using Holt Winter's method.
2. From the implementation of forecasting system that has been built using the value of alpha = 0.9, beta = 0.1 and gamma 0.1 which has been through the test with the train data then obtained the best value of MSE and MAPE which then tested in 2016 from the data of instant cement production with results as follows:
3. For multiplyative instant cement production data value of MSE = 52347.63, and MAPE = 6,649.
4. For data of instant cement production additive value of MSE = 50560.88, and MAPE = 6,619.
5. Holt-Winters Method Additive seasonal method is more accurate than Multiplicative seasonal method in predicting data of instant cement production in 2016 in CV. Trijaya Abadi.

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