OMNET SALES DIGITAL PROTECTION WITH BOX JENKINS AND DELPHI METHOD (CASE STUDY: PT MEDIA VIRTUAL INDONESIA)

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ABSTRACT

To be able to develop sales turnover digital newspaper Jawa Pos, PT. Media Virtual Indonesia requires an app forecasting a sales turnover. The method used in forecasting the quantitative turnover using ARIMA method (Box Jenkins) while for forecasting the skin using Delphi method. The results showed ARIMA AR method became an option because it has the smallest MSE error that is ARIMA AR 3525.36963, ARIMA MA 3803.33228, while ARIMA ARMA 4176.79443. While with the Delphi method, the main problem is the increase in selling power of Digital Java Pos newspaper, while the results obtained at each stage is Phase 1: Which region will be the concentration of sales: Bandung City with points 7. Stage 2 How to introduce the product to the surrounding community? : Held a Local Event.

Keywords: *ARIMA Box Jenkins, Delphi, Sales Turnover*

INTRODUCTION

Forecasting or Forecasting is a fundamental requirement that every company needs to monitor market desires. In an economic repository, designing is a big need, because the grace period for making decisions can range from a few years to several days and even hours. Forecasting is very useful to determine marketing techniques that are considered appropriate, how much production will be generated, targets and turnover to be achieved to the market direction and trend of a product

In the implementation of forecasting techniques commonly used as a technique to determine sales targets or turnover that can be achieved in the next few years. That way, companies can customize and determine which marketing techniques to use.

LITERATURE REVIEW

According to Sugiarto and Harihono (2000), forecasting is a study of historical data to find relationships, trends and systematic patterns. In the business world, forecasting results can provide a picture of the future of the company that allows management to make plans, create business opportunities and manage investment patterns. The accuracy of business forecasting results will increase the chances of achieving a profitable investment. The higher the accuracy of forecasting, the more important the role of forecasting in the firm, because the results of a forecasting can provide direction for corporate planning, product and market planning, sales planning, production planning and finance.

By forecasting, planners and decision makers will be able to consider broader strategic alternatives than without forecasting. Thus, various strategic plans and actions can be developed to address the possibilities that may occur in the future (Sugiarto and Hariono, 2000).

According to Heizer and Render (2006), forecasting is the art, the science to predict future events. This is done by involving retrieval of past data and placing it in the future with a form of mathematical model or intuition predictions being subjective, or using a combination of mathematical models tailored to a manager's good judgment. Forecasting is concerned with predicting what happens in the future, based on scientific methods (science and technology) and done mathematically. However, forecasting activities are not solely based on scientific or organized

procedures, because there are Forecasting activities that use intuition (feeling) or through informal discussions within a group (Santoso, 2009).

According to Heizer and Render (2006), forecasting is usually based on the future time horizon it covers. The time horizon is divided into several categories:

1. Short-term forecasting. This forecast covers a period of up to one (1) year but is generally less than three (3) months. This forecasting is used to plan purchases, job scheduling, number of workforce, assignment and population level.
2. Mid-term forecasting. Medium-term, or intermediate forecasting generally includes a monthly count of up to three (3) years. This forecasting is useful for planning sales, production planning and budgeting, cash budgets and analyzing various operating plans.
3. Long-term forecasting. Generally for the planning period of three (3) years or more. Long-term forecasting is used to plan new products, capital spending, location or facility development, as well as research and development (R & D).

RESEARCH METHODS

Forecasting application sales turnover Java digital newspaper Pos is divided into 2 ie forecasting qualitatively and quantitatively. The initial design of the application is a flow diagram. Here is a flowchart forecasting application in quantitative (ARIMA method Box Jenkins):

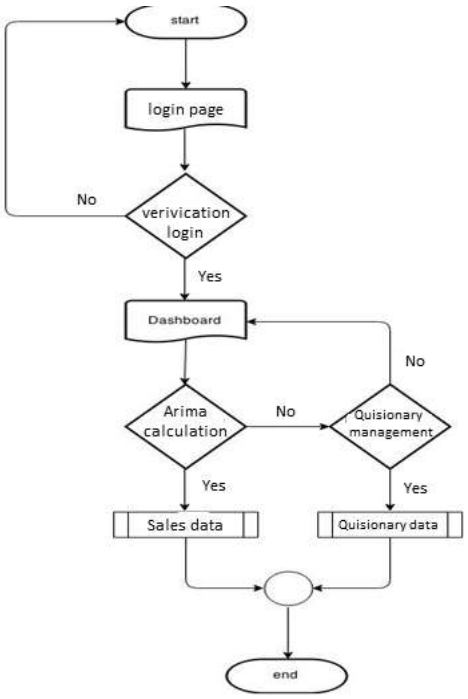

Figure 1. ARIMA System Flow Diagram

Next is the flowchart of forecasting applications quantitatively (Delphi method)

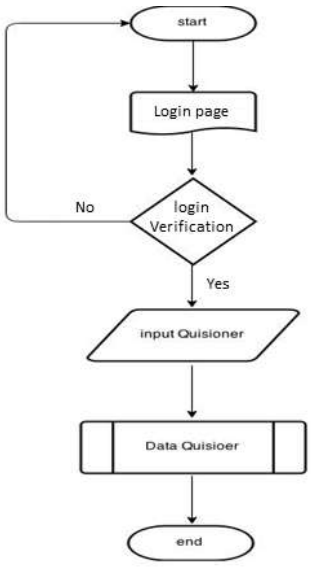

Figure 2. System Flow Chart of the Delphi Method

RESULTS AND DISCUSSION

The process of forecasting turnover is done by 2 methods that are qualitative and quantitative. Quantitatively, forecasting is done using ARIMA method. Data to be predicted from January 2014 to June 2014 at PT. MEDIA VIRTUAL INDONESIA is as follows:

Table 1. sales data from January 2014 to June 2014

Period	Amount of sales data
1 (January 2014)	573
2 (February 2014)	487
3 (March 2014)	732
4 (April 2014)	1131
5 (May 2014)	450
6 (June 2014)	597

The calculation process begins with searching for ACF using equations 3.5, 3.7, and 3.8. Where in this equation calculate ACF, SACF, and TACF. The first step is to calculate ACF in SACF and TACF.

$$r_1 = \frac{(573-661{,}67)(487-661{,}67)+(487-661{,}67(732-661{,}67)+ \ldots+(450-661{,}67)(597-661{,}67)}{(573-661{,}67)^2+ (487-661{,}67)^2+ \ldots+ (450-661{,}67)^2}$$

$$r_1 = \frac{-49442{,}44}{312575{,}33} \qquad r_1 = -0{,}158$$

$$s_{r1} = \frac{(1 + 2\,(0)^2)^{1/2}}{(6-1+1)^{1/2}} \qquad s_{r1} = 0{,}408$$

$$t_{r1} = \frac{-0{,}158}{0{,}408} \qquad t_{r1} = -0{,}387$$

$$r_2 = \frac{(573-661{,}67)(732-661{,}67)+(487-661{,}67)(1131-661{,}67)+\cdots+(1131-661{,}67)(597-661{,}67)}{(573-661{,}67)^2+(487-661{,}67)^2+\ldots+(450-661{,}67)^2}$$

$$r_2 = \frac{-133450.55}{312575.55} \qquad r_2 = \text{-}0{,}427$$

$$s_{r2} = \frac{(1+2(0{,}158)^2)^{\frac{1}{2}}}{(6-1+1)^{\frac{1}{2}}} \qquad s_{r2} = 0{,}418$$

$$t_{r2} = \frac{-0{,}427}{0{,}418} \qquad t_{r2} = -1{,}021$$

$$r_3 = \frac{(573-661{,}67)(1131-661{,}67)+(487-661{,}67)(450-661{,}67)+(732-661{,}67)(597-661{,}97)}{(573-661{,}67)^2+(487-661{,}67)^2+\ldots+(450-661{,}67)^2}$$

$$r_3 = \frac{-9191{,}33}{312575{,}33} \qquad r_3 = -0{,}029$$

$$s_{r3} = \frac{(1+2(-0{,}158)^2+(0{,}427)^2)^{1/2}}{(6-1+1)^{1/2}} \qquad s_{r3} = 0{,}485$$

$$t_{r3} = \frac{-0{,}029}{0{,}486} \qquad t_{r3} = -0{,}061$$

$$r_4 = \frac{(573-661{,}67)(450-661{,}67)+(487-661{,}67)(597-661{,}67)}{(573-661{,}67)^2+(487-661{,}67)^2+\ldots+(450-661{,}67)^2}$$

$$r_4 = \frac{30062{,}88}{312575{,}33} \qquad r_4 = 0{,}096$$

$$s_{r4} = \frac{(1+2(-0{,}158)^2+(0{,}427)^2+(0{,}029)^2)^{1/2}}{(6-1+1)^{1/2}}$$

$$s_{r4} = \frac{1{,}190}{2{,}449} \qquad s_{r4} = 0{,}486$$

$$t_{r4} = \frac{0{,}096}{0{,}486} \qquad t_{r4} = 0{,}198$$

$$r_5 = \frac{(573-661{,}67)(597-661{,}67)}{(573-661{,}67)^2+(487-661{,}67)^2+\ldots+(450-661{,}67)^2}$$

$$r_5 = \frac{5733{,}77}{312575{,}33} \qquad r_5 = 0{,}018$$

$$s_{r5} = \frac{(1+2(-0{,}158)^2+(0{,}427)^2+(0{,}029)^2+(0{,}096)^2)^{1/2}}{(6-1+1)^{1/2}}$$

$$s_{r5} = \frac{1{,}197}{2{,}449} \qquad s_{r5} = 0{,}489$$

$$r_6 = \frac{0}{(573-661{,}67)^2+(487-661{,}67)^2+\ldots+(450-661{,}67)^2}$$

$$r_6 = 0$$

$$s_{r6} = \frac{(1+2(-0{,}158)^2+(0{,}427)^2+(0{,}029)^2+(0{,}096)^2+(0{,}018)^2)^{1/2}}{(6-1+1)^{1/2}}$$

$$s_{r6} = \frac{1{,}198}{2{,}449} \qquad s_{r6} = 0{,}489$$

Table 2. ACF calculation results

Period	ACF	SACF	TACF
1 (January 2014)	-0,158	0,408	-0,387
2 (February 2014)	-0,427	0,418	-1,021
3 (March 2014)	-0,029	0,485	-0,061
4 (April 2014)	0,096	0,486	0,198
5 (May 2014)	0,018	0,489	0,038
6 (June 2014)	0	0,489	0

ACF calculation process can determine the value of q. The value of q can be determined from tr (TACF), where in the above example the result of t_r1 is -0.387 at period 1 (one). Because 1 (first period)> t_r1, then q given value 1. value of this q which will be used for calculation of ARIMA forecasting.

The next step is to find the value of PACF using equation formula 3.9, 3.10 and 3.11 where this formula to calculate the value of PACF followed by SPACF and TACF.

$$r_{11} = r_1 = -0{,}158$$

$$s_{r11} = \frac{1}{(6-1+1)^{1/2}} = 0{,}408$$

$$t_{r11} = \frac{-0{,}158}{0{,}408} = -0{,}387$$

$$r_{22} = \frac{r_2 - r_{11}r_1}{1 - r_{11}r_1}$$

$$r_{22} = \frac{-0{,}427 - ((-0{,}158)(-0{,}158)}{1 - ((-0{,}158)(-0{,}158)} = -0{,}464$$

$$s_{r22} = \frac{1}{(6-1+1)^{1/2}} = 0{,}408$$

$$t_{r22} = \frac{-0{,}464}{0{,}408} = -1{,}137$$

$r_{21} = r_{11} - r_{22}r_1 =$ - 0,158-(-0,463 * -0,158) = -0,232

$$r_{33} = \frac{r_3 - (r_{21}r_2 + r_{22}r_1}{1 - (r_{21}r_1 + r_{22}r_2)}$$

$$r_{33} = \frac{-0{,}029 - ((-0{,}232)(-0{,}427) + (-0{,}464)(-0{,}158))}{1 - ((-0{,}232)(-0{,}158) + (-0{,}464)(-0{,}427))} = -0{,}263$$

$$s_{r33} = \frac{1}{(6-1+1)^{1/2}} = 0{,}408$$

$$t_{r33} = \frac{-0{,}263}{0{,}408} = -0{,}645$$

$r_{31} = r_{21} - r_{33}.r_{22} =$ -0,232 – $(-0{,}263)(-0{,}464) =$ - 0.354

$r_{32} = r_{22} - r_{33}r_{22} = -0{,}464 - (-0{,}263)(-0{,}464) =$ -0.525

$$r_{44} = \frac{r_4 - (r_{31}r_3 + r_{32}r_2 + r_{33}r_1)}{1 - (r_{31}r_1 + r_{32}r_2 + r_{33}r_3)}$$

$$r_{44} = \frac{0{,}096 - ((-0.354 * -0{,}029) + (-0.525 * -0{,}427) + (-0{,}263 * -0{,}158))}{1 - ((-0.354 * -0{,}158) + (-0.525 * -0{,}427) + (-0{,}263 * -0{,}029))} = -0{,}253$$

$r_{41} = r_{31} - r_{44}.r_{33} = -0.354 - (-0{,}253 * -0{,}263) = -0.420$

$r_{42} = r_{32} - r_{44}r_{32} = -0.525 - (-0{,}253 * -0.525) = -0{,}657$

$r_{43} = r_{33} - r_{44}r_{31} = -0{,}263 - (-0{,}253 * -0.354) = -0{,}353$

$$r_{55} = \frac{r_5 - (r_{41}r_4 + r_{42}r_3 + r_{43}r_2 + r_{44}r_1)}{1 - (r_{41}r_1 + r_{42}r_2 + r_{43}r_3 + r_{44}r_4)}$$

$$r_{55} = \frac{-0.151}{0{,}667} = -0.226$$

$r_{51} = r_{41} - r_{55}.r_{44}$

$r_{52} = r_{42} - r_{55}.r_{43}$

$r_{53} = r_{43} - r_{55}.r_{42}$

$r_{54} = r_{44} - r_{55}.r_{41}$

$$r_{66} = \frac{r_6 - (r_{51}r_5 + r_{52}r_4 + r_{53}r_3 + r_{54}r_2 + r_{55}r_1)}{1 - (r_{51}r_1 + r_{52}r_2 + r_{53}r_3 + r_{54}r_4 + r_{55}r_5)}$$

$r_6 = -0.189$

Table 3. PACF calculation results

Period	PACF	SPACF	TPACF
1 (January 2014)	-0,158	0,408	-0,387
2 (February 2014)	-0,464	0,408	-1.135
3 (March 2014)	-0,263	0,408	-0,645
4 (April 2014)	-0,252	0,408	-0,618
5 (May 2014)	-0,226	0,408	-0,555
6 (June 2014)	-0,189	0,408	-0,462

The process of calculating this PACF can determine the value of p. The p value can be determined from tr (TPACF) where in the above example the result of 〖tr〗 _11 is -0.387 at period 1 (one). Since 1 (first period)> 〖tr〗 _11, then p is given value 1. this p value will be used for ARIMA forecasting calculation. The next process is to determine ARIMA method where if for this data ARIMA method is ARIMA (1.0,0) / AR, ARIMA (0,0,1) / MA, and ARIMA (1,0,1) / ARMA.

AR Forecasting Calculation (ARIMA (1.0.0))

The AR calculation process can be calculated using the equation formulas 3.12, 3.13, and 3.14. The calculation process can be seen as follows.

$$Z = \begin{bmatrix} 1 & 573 \\ 1 & 487 \\ 1 & 732 \\ 1 & 1131 \\ 1 & 450 \end{bmatrix}, \mathrm{Y} = \begin{bmatrix} 487 \\ 732 \\ 1131 \\ 450 \\ 597 \end{bmatrix}, Z' = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 573 & 487 & 732 & 1131 & 450 \end{bmatrix}$$

$$Z'\mathrm{Z} = \begin{bmatrix} 5 & 3373 \\ 3373 & 2582983 \end{bmatrix}, Z'Y = \begin{bmatrix} 3397 \\ 2241027 \end{bmatrix}$$

$$(Z'\mathrm{Z})^{-1} = \begin{bmatrix} 1{,}679 & -0{,}00219 \\ -0{,}00219 & 0{,}00000325 \end{bmatrix}$$

$$\hat{\beta} = \begin{bmatrix} 790{,}363 \\ -0{,}1645 \end{bmatrix}$$

From the above parameters results can be seen the results of the AR equation that is X_t = 790,363-0,1645 X_ (t-1) + e t. Having known the equation can calculate AR forecasting. The results of AR forecasting can be seen in table 4

Table 4. Forecasting Table AR

Periode	Original Data	Forecast Data	Error
1 (January 2014)	573	681,53	-108,53
2 (February 2014)	487	696,11	-209,11
3 (March 2014)	732	710,26	21,74
4 (April 2014)	1131	669,96	461,04
5 (May 2014)	450	604,33	-154,33
6 (June 2014)	597	716,34	-119,34

The above error result can be used to calculate the value of MSE by using equation formula 3.18.

$$\mathrm{MSE} = \frac{(-108{,}53 * -108{,}53)+(-209{,}11 * -209{,}11)+\cdots+(-119{,}34 * -119{,}34)}{6}$$

MSE = 51.099,69

MA Forecasting Calculation (ARIMA (0,0,1))

MA calculation process can be calculated using equation formula 3.15 and 3.16. The calculation process can be seen as follows.

$$Z = \begin{bmatrix} 1 & 573-487 \\ 1 & 487-732 \\ 1 & 732-1131 \\ 1 & 1131-450 \\ 1 & 450-597 \end{bmatrix}, Z = \begin{bmatrix} 1 & 86 \\ 1 & -245 \\ 1 & -399 \\ 1 & 681 \\ 1 & -147 \end{bmatrix}, \mathrm{Y} = \begin{bmatrix} 487 \\ 732 \\ 1131 \\ 450 \\ 597 \end{bmatrix},$$

$$Z' = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 86 & -245 & -399 & 681 & -147 \end{bmatrix}$$

$$Z'Z = \begin{bmatrix} 5 & -24 \\ -24 & 711992 \end{bmatrix}, Z'Y = \begin{bmatrix} 3397 \\ -370036 \end{bmatrix}$$

$$(Z'Z)^{-1} = \begin{bmatrix} 0{,}20003 & 0{,}0000067 \\ 0{,}0000067 & 0{,}0000014 \end{bmatrix}$$

$$\hat{\beta} = \begin{bmatrix} 677{,}015 \\ -0{,}497 \end{bmatrix}$$

From the above parameter results can be seen the results of its MA equation is X_t = 677,015 + e_t-0.497 e_ (t-1). Having known the equation can calculate MA forecasting. The result of MA forecasting can be seen in table 5.

Table 5. MA Forecasting Table

Periode	Original Data	Forecast Data	Error
1 (January 2014)	573	677,51	-104,51
2 (February 2014)	487	625,08	-138,08
3 (March 2014)	732	608,40	123,60
4 (April 2014)	1131	738,43	392,57
5 (May 2014)	450	872,08	-422,08
6 (June 2014)	597	467,28	-129,72

The above error result can be used to calculate the value of MSE by using equation formula 3.18.

$$MSE = \frac{(-104{,}51 * -104{,}51) + (-138{,}08 * -138{,}08) + \ldots + (-129{,}72 * -129{,}72)}{6}$$

MSE = 65.726,08

ARMA Forecasting Calculation (ARIMA (1.0.1))

ARMA calculation process can be calculated by using equation formula 3.17.PARMA ARMA obtained from merging AR and MA. The ARMA equation is x_t = 790,363-0,1645X_ (t-1) + e_t - (- 0,4968) e_ (t-1) the result of ARMA forecasting can be seen in table 6.

Tabel 6. ARMA Forecasting Table

Period	Original Data	Forecast Data	Error
1 (January 2014)	573	681,53	-108,53
2 (February 2014)	487	642,18	-155,18
3 (March 2014)	732	633,15	98,85
4 (April 2014)	1131	719,08	411,92
5 (May 2014)	450	808,01	-359,01

6 (June 2014)	597	537,95	59,05

The above error result can be used to calculate the value of MSE by using equation formula 3.18.

$$MSE = \frac{(-108{,}53 * -108{,}53) + (-155{,}18 * -155{,}18) + \ldots + (59{,}05 * 59{,}05)}{6}$$

MSE = 57.947,93

Figure 3. Graphs of Omzet Sales of Newspaper Semester Early 2014

As for forecasting using Delphi method is as follows:

Table 7. Expert Data

Expert Name	Position
R. Soegiharto	Director
Unggul Irajanto	Marketing Manager
Moch. Syamsul Baidlowi	IT Manager
Dita Rahmawati	Marketing Staff
Syarif Hidayat	IT Staff / Programmer

The main issues that will be discussed is the increase of selling power Digital Newspaper Java Pos. Here are the alternatives available to determine which city concentration sales Digital Newspaper Jawa Pos:

1. Surabaya
2. Jakarta
3. Bandung
4. Semarang
5. Malang
6. Yogyakarta

After the questionnaire is done then mnculah results of the following table:

Table 8. Quisioner Evaluation 1

Evaluation 1						
Alternatif	**Experts 1**	**Experts 2**	**Experts 3**	**Experts 4**	**Experts 5**	**Average**
Surabaya	6	5	4	6	3	**5**
Jakarta	3	4	5	2	6	3
Bandung	6	5	3	6	4	**6**
Semarang	4	4	4	3	6	2
Malang	6	5	5	5	5	**5**
Yogyakarta	3	2	3	4	4	4

Because of the development of questionnaire Evaluation 1 then the question arises that can be developed by the experts that is "How to introduce the product to the surrounding community?" So from it tercipatah table hollow

Table 9. Quisionary Evaluation 2

Evaluation 2						
Alternatif	**Experts 1**	**Experts 2**	**Experts 3**	**Experts 4**	**Experts 5**	**Average**
Mengadakan Local Event	6	5	6	6	5	**6**
Promo Harga Paket	3	4	5	2	6	4
Voucher Bonus	3	5	3	3	4	**3**

1. After the process of forecasting through ARIMA (Box Jenkins) and Delphi method can be known ARIMA AR method with MSE 3525.36963
2. In the implementation of Delphi method can be concluded that the right location in the development of market share area is the city of bandung with menagadakan local event as the appropriate media campaign.

REFERENCES:

[1] Rosydiiah 2005. Thesis: Forecasting ARIMA in Forecasting Passenger Railway in Area Operation IX Jember. Department of Mathematics University of Jember.
[2] Aritonang, Lerbin R.R .. 2009, Business Forecasting, Ghalia Indonesia, Jakarta
[3] Makridakis, Spyros. 1999. Forecasting Methods and Applications. Volume I. 2nd Edition. Erland. Jakarta. Translated by Untung Sus Andriyanto and Abdul Basith. Pp. 391-491.
[4] Al Wasilah, Chaedar 2009. Fundamentals of designing and conducting qualitative research. Bandung: Pustaka Jaya.
[5] Soejati, Zanzawi. 1987. Time Range Analysis. Jakarta: Publisher sKanunik Unversitas Terbuka.