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2018 5th International Conference on Electrical Engineering, Computer Science and Informatics (EECSI 2018)

16-18 October 2018, Malang, Indonesia

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2018 5th International Conference on Electrical Engineering, Computer Science and Informatics (EECSI 2018)

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Foreword from General Chair EECSI 2018

Foreword General Chair

In the name of Allah, the Most Beneficent, the Most Merciful.
Welcome to the 2018 5th International Conference on Electrical Engineering, Computer Science and Informatics (EECSI 2018) in Malang, Indonesia.

The 5th EECSI 2018 is themed "Toward the Next Generation of Technology". This conference provides academicians, researchers, professionals, and students from various engineering fields and with cross-disciplinary working or interested in the field of Electrical Engineering, Computer Science, and Informatics to share and to present their works and findings to the world.

I would like to express my highly gratitude to all participants for attending, sharing and presenting your ideas and experiences in this interesting conference. Almost 300 papers had been submitted to EECSI 2018. However, the only high quality papers are selected and accepted to be presented in this event. We are also thankful to all the international committee, international reviewers, and steering committee for their valuable support. I would like to give a praise to all partners in publications and sponsorships for their valuable supports, especially for Ministry of Research and Higher Education (Kemenristekdikti) Indonesia.

Organizing a prestigious conference was incredibly challenging and would have been impossible to be held without outstanding committees. Such that, I would like to extend my sincere appreciation to all organizing committees and volunteers from Universitas Muhammadiyah Malang as a host and all colleagues from Universitas Diponegoro, Universitas Ahmad Dahlan, Universitas Sriwijaya, Universitas Islam Sultan Agung, Universitas Gadjah Mada, Universitas Budi Luhur, Universiti Teknologi Malaysia, and IAES Indonesia Section for providing me with much needed support, advice, and assistance on all aspects of the conference. A special thanks also for lEEE Indonesia Section for their contribution as technical co-sponsorship of the conference. We do hope that this event will encourage the collaboration among us now and in the future.

We wish you all find opportunity to get rewarding technical program, intellectual inspiration, renew friendships and forge innovation, and that everyone enjoys Malang.

Assoc. Prof. DR. Tole Sutikno
General Chair EECSI 2018

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Foreword from IAES Indonesia Section

Bismillahirrohmannirrahim,
In the name of Allah Al Mighty, The Most Gracious, The Most Merciful

We are pleased to welcome our colleagues in the International Conference on Electrical Engineering, Computer Science and Informatics (EECSI 2018) in Malang, City of Heritage on October 16-18th, 2018.

It must be said proudly that the EECSI has been rolled out for five times since it was firstly initiated on year 2014 in Yogyakarta. Our colleagues all over the world supporting by many tops universities have successfully organized the conference to become the prestigious international annual event in Indonesia.

A highest appreciation is addressed to The Ministry of Research, Technology and Higher Education (Kemenristekdikti) Republic of Indonesia for a worthy technical and financial support during the conference and special thanks for IEEE Indonesia Section for the technical co-sponsorship for this prominent occasion. We do hope that this event will strengthen the collaboration among us now and in the future.

This year, the achievement in this conference is due to valuable contributions from our colleagues from Universitas Muhammadiyah Malang supporting by Universitas Diponegoro, Universitas Ahmad Dahlan, Universitas Sriwijaya, Universitas Islam Sultan Agung, Universitas Gadjah Mada, Universitas Budi Luhur and Universiti Teknologi Malaysia. I would like to express my sincere gratitude and appreciation for all partners, friends, Organizing committee, reviewers, keynote speakers, and participants who have made this event as great as today.

I would also like to extend my gratitude to Rector of Universitas Muhammadiyah Malang who friendly becomes a main host for this great conference. We optimist many following collaborative works will be carried out among us and all participants.

I hope you all had a nice time at the conference where all of you are able to learn something new, renewed and created new networks and at the same time have some fun in Malang City during the conference and Mount Bromo during the cultural tour.

Thank you.

Assoc. Prof. Mochammad Facta, Ph.D
IAES – Indonesia Chapter

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Foreword from Rector of Universitas Muhammadiyah Malang

The advent of the next generation of technology, renown as Technology 4.0, is unavoidably incessant. This so-called technology has offered a new horizon in various aspects of man-beings' lives. To be particular in the fields of electrical engineering, electronics, computer science, computer engineering, and informatics, Technology 4.0 plays its potent role to underpin the future advancement of technology for the coming generations. Scientific forum titled as the 2018 5th International Conference on Electrical Engineering, Computer Science, and Informatics (EECSI 2018) hosted by University of Muhammadiyah Malang in collaboration with a number of universities is the manifestation of continuous effort to aim for the ever-changing technology.

Hereby, I would like to congratulate the Faculty of Engineering, University of Muhammadiyah Malang for their effort in organizing the 2018 5th International Conference on Electrical Engineering, Computer Science, and Informatics (EECSI 2018). I appreciate all co-organizers such as Universitas Diponegoro, Universitas Ahmad Dahlan, Universitas Sriwijaya, Universitas Islam Sultan Agung, Universitas Budi Luhur, and Universiti Teknologi Malaysia for their support in this mutual collaboration. Without the full and valuable supports from the international committee, international reviewers, and steering committee, this international conference remains a detached discourse without high commitment to conduct.

The expression of my high gratitude is devoted to the Ministry of Research, Technology, and Higher Education (Kemenristekdikti) Republic of Indonesia, IEEE Indonesia Section, and IAES Indonesia Section for their support to this event as the sponsors and technical co-sponsorship, respectively. Expectantly, this would be the initial and continual collaboration in the future.

To all speakers, presenters, and participants, thank you for participating and welcome to this conference. The success of this conference owes so much on your participation and contribution in promoting the knowledge, information, and robust creativity. To end with, this conference expectedly becomes an arena to build mutual ties among the academicians, researchers, industries, and society.

All the best to EECSI 2018

Dr. H. Fauzan, M.Pd.
Rector
Universitas Muhammadiyah Malang - Indonesia

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Winter Exponential Smoothing: Sales Forecasting on Purnama Jati Souvenirs Center

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***Abstract*— Forecasting is the process of making predictions of the future based on past and present data and most commonly by analysis of trends. In sales area, an accurate sales forecasting system will help the company to improve the customers' satisfaction, reduce destruction of products, increase sales revenue and make production plan efficiently. Purnama Jati is a typical Jember souvenir place like "prol tape", "pia tape", "brownies tape" and so forth. Every day, sales on every outlet is uncertain so Purnama Jati repeatedly send to the outlets if the stock has run out. This research will focuse on "prol tape" cake, "pia tape" cake product as the research object. In this research we will use winter exponential smoothing as a forecasting method due to suitable character with the case.**

Keywords: forecasting, sales, purnama jati

I. INTRODUCTION

Forecasting is the process of making predictions of the future based on past and present data and most commonly by analysis of trends[1]. A commonplace example might be estimation of some variable of interest at some specified future date. In sales area, an accurate sales forecasting system will help the company to improve the customers' satisfaction, reduce destruction of products, increase sales revenue and make production plan efficiently[2].

Purnama Jati is one of famous souvenir center in the city. Purnama Jati is a typical Jember souvenir place like "prol tape", "pia tape", "brownies tape" and so forth. Almost all Purnama Jati products are "tape" based. "Tape" is a snack generated from the fermentation process of carbohydrate foods (cassava) as the substrate by yeast. Purnama Jati produces several products every day such as prol tape and pia tape because these two products are the best selling in the market. Then the products will distribute to all outlets. Every day, sales on every outlet is uncertain, so Purnama Jati repeatedly send to the outlets if the stock has run out. As a result, in a day Purnama Jati can perform several times production. Repeated production certainly waste time and money. This research will focus on "prol tape" cake, "pia tape" cake product as the research object.

This research was conducted to produce the correct forecasting with case study at Purnama Jati souvenir center. In this case, we realize that there is a need of information. An information that figure the amount of "how much stock that they need?". The stock is related with the question "how much the next product sold out?". Based on this need, in this research we will do forecasting for the product sales.

In this research we will use winter exponential smoothing as a forecasting method. We will try to forecast sales for the next day. By doing the forecasting, we will figure out how accurate are the method implementation to the Purnama Jati sales data pattern by calculating the percentage error.

II. METHODS

Sales data pattern on Purnama Jati are stationary (Fig.1), trend (Fig.2) and seasonal patterns (Fig.3). The stationary data is closely related to the statistical habits of data at a given time and this is often characterized by a constant probability distribution over time[3].

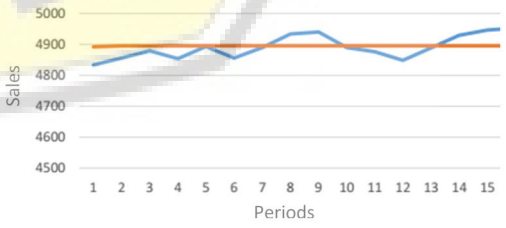

Fig. 1. Stationary data pattern

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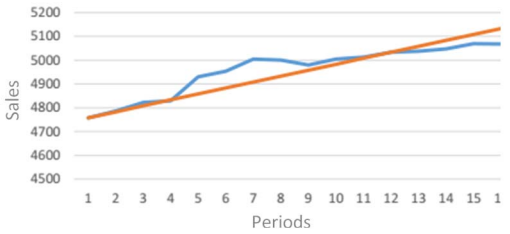

Fig. 2. Trend data pattern

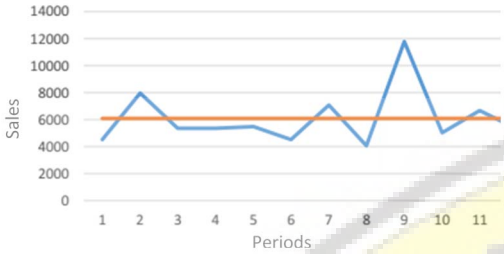

Fig. 3. Seasonal data pattern

Stationary data moves on average data. Data may experience a gradual shift or a relatively higher or lower movement over a longer period of time. Data with these habits is called trend patterned data. Trend data is usually the result of long-term factors such as an increase or decrease in a particular character[4]. Seasonal data can be seen from the existence of repeating patterns in a row in a certain period[5]. Patterns formed by seasonal data can be a significant decrease and increase and fluctuate high.

A. Winter Exponential Smoothing

Winter Exponential Smoothing(WES) method is used for data patterns with movements that change following the season or trend[6]. This method is one of the popular methods used for seasonal patterned data. In addition to using the level / stationary factor and Winter method trends also use seasonal factors for each season[7]. Amrit Pal Singh, et al.[8] on their research comparing winter exponential smoothing with Moving Average, Single Exponential Smoothing, and Double Exponential Smoothing. The case studied is a shoe company where there is often a spike in demand or unpredictable demand. And the conclusion of this study after comparing the 4 methods found that the Winter Exponential Smoothing method is suitable for data on case studies. In the method proposed by this winter, it is based on 3 (three) refinement parameters[6], i.e one for element, one for trend, and one for seasonal.

$$A_t = \frac{\alpha Yt}{St-L} + (1-\alpha)\,(A_{t-1} + T_{t-1}) \quad (1)$$

$$T_t = \beta(A_t - A_{t-1}) + (1-\beta)T_{t-1} \quad (2)$$

$$S_t = \frac{\gamma Yt}{At} + (1-\gamma)\,S_{t-L} \quad (3)$$

$$F_{t+p} = (A_t + pY_t)S_{t-L+p} \quad (4)$$

At = Smoothing Value
α = Smoothing Constant (0 < α < 1)
Yt = Actual value in t period
β = Smoothing constant for trend estimation (0 < β < 1)
T_t = Trend estimation
γ = Smoothing constant for seasonal (0<γ<1)
St = Seasonal estimates measured as indexes
L = Long season
p = Number of periods to forecast
Ft+p = Forecasting results for p period

B. Mean Absolute Percentage Error

Mean Absolute Percentage Error (MAPE) is a calculation to measure the accuracy of the results of a forecasting method[9]. This method calculates the average absolute value of the percentage original data error with the data forecasting result(5)[10].

$$MAPE = \frac{\sum\left|\left(\frac{Et}{Yt}\right)*100\right|}{n} \quad (5)$$

Et = Error Absolute Value
Yt = Actual value
n = Amount of data

III. Results and Discussion

MAPE value able to reflects accuracy level of a forecast. It is said to have very good accuracy if the MAPE value is less than or equal to 10%, has good accuracy if less than or equal to 20%, can be quite accurate if less than or equal to 30% and said less accurate if more than 30%[11].

In this research the forecasting calculation based on last 7 days data. WES method requires the parameter of number of seasons for each calculation, in this study the number of seasons used is 7 because the data provided is the daily data in one month. The calculation of forecasting using the WES Method required 3 constants i.e α, β, and γ. In the determination of the value of the constant must consider the constant value that has the smallest MAPE results.

The constants α, β, and γ have the provision that $0 \leq \alpha \leq 1$, $0 \leq \beta \leq 1$, and $0 \leq \gamma \leq 1$. And obtained the value of α, β, and γ with the smallest MAPE value for 31 days for "Prol Tape Besar" product is α = 0.069, β = 0.78 dan γ = 0.01, for "Prol Tape Kecil" products are α = 0.23, β = 0.15 and γ = 0.01 and for "Pia Tape" is α = 0.03, β = 0.99 and γ = 0.01. According to sales forecasting MAPE from Table 1, 2 and 3 MAPE value is above 20% and below 30%.

TABLE 1. Sales Forecasting Results of "Prol Tape Besar" in October 2016

Dates	Yt (Actual)	Ft	APE
1-Oct-16	227		
2-Oct-16	219		
3-Oct-16	156		
4-Oct-16	150		
5-Oct-16	135		
6-Oct-16	172		
7-Oct-16	249		
8-Oct-16	240	231	4
9-Oct-16	243	229	6
10-Oct-16	183	167	8
11-Oct-16	138	167	21
12-Oct-16	119	151	27
13-Oct-16	152	191	26
14-Oct-16	258	271	5

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15-Oct-16	190	245	29
16-Oct-16	302	228	24
17-Oct-16	223	166	26
18-Oct-16	132	165	25
19-Oct-16	127	147	16
20-Oct-16	173	186	7
21-Oct-16	189	266	41
22-Oct-16	0	232	100
23-Oct-16	173	192	11
24-Oct-16	153	123	20
25-Oct-16	122	109	11
26-Oct-16	77	89	16
27-Oct-16	173	100	42
28-Oct-16	144	140	3
29-Oct-16	169	116	32
30-Oct-16	92	109	18
31-Oct-16	199	70	65
		Mean	**24**

TABLE 2. Sales Forecasting Results of "Prol Tape Kecil" in October 2016

Dates	Yt (Actual)	Ft	APE
1-Oct-16	151		
2-Oct-16	166		
3-Oct-16	175		
4-Oct-16	119		
5-Oct-16	111		
6-Oct-16	120		
7-Oct-16	91		
8-Oct-16	151	140	8
9-Oct-16	202	144	29
10-Oct-16	119	156	31
11-Oct-16	120	92	23
12-Oct-16	99	85	14
13-Oct-16	123	89	28
14-Oct-16	158	69	56
15-Oct-16	147	147	0
16-Oct-16	187	160	14
17-Oct-16	185	173	6
18-Oct-16	118	120	1
19-Oct-16	92	111	20
20-Oct-16	89	114	28
21-Oct-16	114	81	29
22-Oct-16	0	145	100
23-Oct-16	160	117	27
24-Oct-16	98	128	30
25-Oct-16	157	78	50
26-Oct-16	73	88	21
27-Oct-16	93	90	3
28-Oct-16	105	68	35
29-Oct-16	238	124	48
30-Oct-16	95	172	81
31-Oct-16	176	162	8
		Mean	**29**

TABLE 3. Sales Forecasting Results of "Pia Tape" in October 2016

Dates	Yt (Actual)	Ft	APE
1-Oct-16	69		
2-Oct-16	102		
3-Oct-16	79		
4-Oct-16	40		
5-Oct-16	55		
6-Oct-16	64		
7-Oct-16	74		
8-Oct-16	62	70	13
9-Oct-16	88	104	18
10-Oct-16	68	80	18
11-Oct-16	50	40	19
12-Oct-16	88	56	36
13-Oct-16	96	68	29
14-Oct-16	94	83	12
15-Oct-16	63	80	27
16-Oct-16	118	121	3
17-Oct-16	72	96	34
18-Oct-16	39	49	27
19-Oct-16	54	69	27
20-Oct-16	62	80	29
21-Oct-16	73	91	25
22-Oct-16	0	84	100
23-Oct-16	83	116	40
24-Oct-16	67	85	26
25-Oct-16	65	40	38
26-Oct-16	47	54	16
27-Oct-16	58	60	3
28-Oct-16	75	66	12
29-Oct-16	57	58	1
30-Oct-16	68	82	100
31-Oct-16	92	59	36
		Mean	**29**

Based on the forecasting result of 3 products Purnama Jati (Prol Tape Besar, Prol Tape Kecil and Pia Tape) in October 2016, the WES implementation is quite accurate. Can be seen in Tables 1, 2 and 3, MAPE values of three products, Prol Tape Besar: 24%, Prol Tape Kecil : 29%, and Pia Tape: 29%.

However, there are some data whose error value is greater than 30% and the forecasting results for the data are said to be inaccurate. This happens because of a spike in data changes that are too high and do not match the pattern. Thus causing chaos on forecasting calculations. Data changes occur because of things that can not be determined. In this case, we analyse deeper on the field. To figure out what happened. And we found out that the possibility of data changes occurs due to holiday outlets or due to declining sales.

IV. CONCLUSION

It can be inferred that implementation of WES methods for this case (daily data) is quite accurate. It is indicated by the results of MAPE calculations on all product categories between 20%-30%. This happens because there are some data whose error value is greater than 30% and the forecasting results for the data are said to be inaccurate. Another problem is the limitation from this research is data availability. Purnama Jati only provides data in one month. The data obtained in this study is too small. It is highly recommended to use more complete data. By using more complete data it is possible to produce more accurate forecasting results.

However, the decision to use WES as forecasting method in this case is suitable with the case character (stationary, seasonal and trend data patterns). It is compared with Single Exponential Smoothing that just accommodate stationary data and Double Exponential Smoothing for stationary and trend data pattern.

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