

# **The Effectiveness of Simple Time Series Implementation in the Culinary Industry: A Systematic Literature Review**

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## **Abstract**

Forecasting as demand in the culinary industry is very necessary for decision making in the supply of culinary ingredients and reducing stock outs that often occur. This study uses a single moving average (SMA) and single exponential smoothing (SES) time series to make a forecast or demand forecast with the culinary industry and raw materials. Forecasting is an attempt to predict what will happen in the future based on previous data or past data based on scientific and qualitative methods that are carried out systematically. (MAPE and Exponential Moving Average (EMA) show that a single moving average has more accurate results when compared to the Single exponential smoothing method. This research method uses systematic interpretation to study and identify the effectiveness of simple time series forecasting, especially the culinary industry. By comparing the accuracy of each SMA and SES methods, SMA has the smallest error rate in forecasting. Therefore, the time series method in predicting time series is simple in the culinary industry. room in the culinary industry, the company uses a good forecasting system for sales, purchases, supply and demand with a simple time series forecasting method, where the industry has succeeded in reducing preparation costs and production inventory costs. with time series forecasting, p this conducted for give integration to be more optimal in development industry culinary that.

## **Keywords**

Culinary industry, forecasting, time series, effectiveness, Systematic Literature Review.

## **I. Introduction**

Research in time series analysis and forecasting has traditionally been concerned with modeling autocorrelation structures in stationary time series. However, as discussed (Fildes, 1983) recent empirical work has shown this to be a relatively unimportant issue compared to trend modeling (Richard, 2019). For example, (Sheren, 2020) evaluating the post-sample accuracy of 21 automated forecasting methods on a set of 1,001 time series the (Antonyio, 2019) accuracy of all methods deteriorates badly on wait times over the next few steps. This is especially true for methods based on linear trends which usually exceed data on long waiting times (Anne, 2019). In its use, a simple time series is used because not all raw materials are sent and needed on the same day and time. in fortune teller n. (Romeo, 2021)The existence of simple time series forecasting of raw materials that is excessive can increase storage costs and will lead to opportunity costs of capital that must be invested in other, more profitable sectors. On the other hand, too many simple time series forecasts of insufficient raw materials will cause the continuity of the production process and company operations to be disrupted (Antonyio, 2019). This causes the company to incur more expensive emergency forecasting costs(Aktepe, 2021).

The problem faced by the management of course wants that the number of demand forecasts produced can meet all requests in accordance with estimates in one period in the future without using a simple time series method. So that the company has difficulty in predicting the amount of production in the future. (Gideon, 2020) With the capacity of resources such as machines, working hours and limited labor, management wants to make decisions by determining the amount of production in order to increase the available capacity (Homigas, 2021). One of the decisions taken by management is to recruit non-permanent employees or apply overtime, in fact it is not uncommon for both to be done if the situation requires time series forecasting (Hamdan, 2021). This time series forecasting method by applying overtime certainly makes production costs increase (Akeu, 2021) And these profits can be used to be allocated to add other investments or to expand the culinary business which already exists

now with the required timeline directly (Anine, 2020). On average, the model improves the accuracy of long-term forecasts compared to the model that assumes a linear trend (Andreas, 2018). This is achieved at no apparent cost in short term performance. (Abigail, 2020) This model is also more suitable for routine use in large forecasting systems, such as in inventory control but, in forecasting or forecasting in time series. (Nano, 2022) Every company needs a concept in the development of methods carried out by the company independently overall where in this case there is an interpretation of the developmental problem of several demand forecasts held by the food and beverage industry and the allocation of various models. (Kraus, 2021) Forecasting structure is one thing that will be considered in the future through measurement in decision making in every company. (Dikanom, 2020) Market sales forecasting allows companies to have optimal inventory levels in making the right production decisions and maintain the efficiency of existing activities in the company as a whole. (Devi, 2021) In the interpretation of this market sales forecasting problem, time series forecasting is used to predict sales of culinary delights in predicting the next period starting year 2020 to 2021 (Almaida, 2021) A concept of interpretation of this forecast using a systematic calculation where the concept of development is in accordance with the demand for food or beverages where the forecast is also one of the company's goals to maintain from demand through a certain time series (Reynold, 2021) In achieving optimal decisions on the company's business activities a method is needed appropriate, systematic and accountable (Brando, 2020). One of the tools needed is a forecasting method. For this reason forecasting is important in planning and serves as an input for many other business decisions (Bernad, 2019)). The decision will be better by using the right forecast (Deno, 2022). The accuracy of a forecast differs for each forecast depending on the various factors (Andrew, 2021) that influence it. (Bilah, 2020) The results of a forecast can not always be ascertained the truth in a matter of 100% absolute, but that does not mean that forecasting has been widely used and helps well in various managements as a basis for planning, monitoring and decision making (Abigail, 2020).

This is one interpretation that a company requires forecasting that is used to develop the company as a whole where in this case the interpretation in making this decision is influenced by several factors where the existence of factors in the company makes the interpretation that there is a concept (Kartik, 2021). The company has integration and also provides intensity (Beri, 2020) with a pattern of structural development and also decision making made by the company as a whole so that it is able to provide benefits by compromising on the forecasting made by the company in achieving a form of production process that will later provide benefits for the company through development of structured interpretation concepts that will (Angela, 2022) have an impact on company forecasters in developing various kinds of market sales that will provide time or time series for the company (Arnold, 2021)

A good fortune-telling is a forecast that approaches forecasting (Roy, 2021) Because forecasting is used as a reference in decision making, good forecasting is needed. The role of forecasting extends to many fields, such as economics, finance, marketing, production, operational research, public administration, meteorology, geophysics and population (Beri, 2020). Because of the magnitude of the forecast, it is necessary to deepen the steps in forecasting (Sezer, 2020). By knowing the steps of good forecasting, it is hoped that good forecasting can be obtained. To achieve a good forecast, it is necessary to have the right model or have a forecast value that is close to the truth of the company. So the researchers took a study entitled "The Effectiveness of the Application of Time Series Forecasting in the Culinary Industry"

### **1.1 Research Problem**

The research problem is that there is a distance between something that is ideal and what is happening or what should be different from what is happening is different, it can also be a gap between reality and expectations. The first thing to do in a study is to explain the topics and issues that are currently being discussed. Because the issues that are hot topics and come to the surface of the audience's conversation are usually because there is a problem and needs to be solved. Research problems can explain facts that aim to strengthen the issue. The research problems in this study are:

1. What is the simple time series forecasting process in the culinary industry?
2. What is the effectiveness obtained from the application of simple time series forecasting in the culinary industry?
3. How to calculate simple time series forecasting in the culinary industry?

### **1.2 Research purposes**

The purpose of the research is an indication of the direction in which the research is being carried out or what data and information are to be achieved from the research. The research objectives are formulated in the form of concrete statements, which can be observed and can be measured. In formulating a research objective, we must be guided by the formulation of the problem.

## **2. Literature Review**

Forecasting or so-called is a form of decision-making process where forecasting is generally used in the past as a form of analysis to study the data that has been collected, the format is studied and also analyzed directly, where forecasting is close to forecasting. reality that exists in various concepts within the scope of the organization or company. The interpretation of this forecast becomes one of the references in making decisions where a good forecast will require a good role in various aspects of finance or marketing which will later provide accuracy or overall forecasts for the forecast results that are calculated to achieve a goal. basic management. (Abigail, 2020) Prediction interpretation is a very important element used in planning and developing a short-term financial control system that will later provide sales forecasts (Arnold, 2021).

Forecasting series time simple time series is implemented in an area of machine learning that focuses on attributes time (Greta, 2022). In accordance name, field this focus on analysis sequential data series to time, then predict the data that will come based on previous data. Time Series divided again Becomes two, namely analysis and forecasting focus on understanding to existing (Anine, 2020) datasets. Here, we more focus on determining trends, connection with factor external, and so on. The point is, we only want to get insight to existing (Almada, 2021) data. Forecasting take more steps far again, that is predict future events, from the insights we get, from barrage events that have happen, we could calculate future events come, thing this of course very useful because with Thing the our can To do many things, like To do anticipation to what will come in the future (Sheren, 2020). There are two tool analysis for use method this *time series*, namely smoothing and decomposition, (Irene, 2019) *Smoothing* base prediction with the average principle of past errors (Averaging smoothing past errors) with method add percentage error prediction previously (percentage of the errors), obtained from difference Among score actually (*actual value*) with score his prediction on the value of forecasting (Angela, 2022). *Decomposition* base prediction with divide data into a number of components, such as trend, cycle, seasonality, and random effects; then combine prediction from components that (except influence *random*).

Simple time series forecasting is a form of forecasting system that better controls the availability of time where the concept of forecasting development uses several methods used in forecasting that are used within a certain time scope. (Seker, 2021) The essence of forecasting is the forecasting of future events on the basis of past patterns and the use of policy projections with patterns under past time. Forecasting requires policy, while projection is a mechanical function. (Bila, 2020) This forecasting concept requires a form in the development of an interpretation that will be realized by the company as a whole which in this case provides a form of illustration that the existence of this forecasting is one of the most important things to be carried out within the scope of the company as a whole. overall to find out how it is. in the future (Nano, 2022). Forecasting is one of the most important things in the form of time in a comprehensive interpretation where in this case developing a forecasting concept in a structured scope is one very important thing to do, especially if forecasting interpretation is able to provide concept development for market development. (Rahmat, 2021) The function or forecast is seen at the time of decision making. Good decisions are decisions that are based on consideration of what will happen when the decision is implemented. If the predictions that we make are not accurate, then the problem of forecasting is also a problem that we always face. The function of forecasting is for decision making. According to Render and Heizer (2005) forecasting is the art and science of predicting future events. This sales forecast is about the number of products that will be ordered or requested in the future period and the forecast is obtained from product demand data in the previous period. With forecasting, the company can make the right decisions in its production, but in forecasting activities require the application of methods, this aims to be able to find out future requests and minimize forecasting errors. (Arnold, 2021).

## **3. Methodology**

This research method uses systematic interpretation to study and identify the effectiveness of simple time series forecasting, especially in the culinary industry. The existence of a Systematic Literature Review (SLR) is a form of research related to existing publications and follows a systematic methodology to compile various published data to calculate forecasts for the existing culinary industry (Kraus, 2021). The SLR method makes it easier for researchers to explore what they want to learn about simple time series forecasting, which by following a predetermined process for conducting a literature review can allow researchers to provide actual evidence regarding data sources and criteria for selecting problem analysis. in the culinary industry (Roma, 2021) The SLR method makes it easier for researchers to dig further into the things they want to research, which by following a predetermined process for conducting a literature review can allow researchers to provide actual evidence regarding data sources and criteria in selecting problem analysis related to time. simple series. forecasting in the culinary industry. (Brand, 2020). Qualitative forecasting methods are subjective methods rather than quantitative methods. This is because qualitative methods are strongly influenced by a person's background such as emotions, education, intuition, and so on. So everyone's results will likely be different. Estimating the future financial needs of a company is one of the most important uses of forecasting. It can help a company determine its financial future

by estimating future sales, capital required for future product development, future expansion costs and other cost estimates used to estimate future costs. Proper forecasting can reveal important information about future income and expenses. By having an estimate of the funds coming in and going out of the organization over a certain period of time, company management can make future plans more efficient and accurate. In general, there are five steps in the preparation of research using the Systematic Literature Review (SLR) approach by following the basic implementation guidelines on how an article is selected, evaluated, analyzed, and interpreted, in this study as follows in Figure 1:

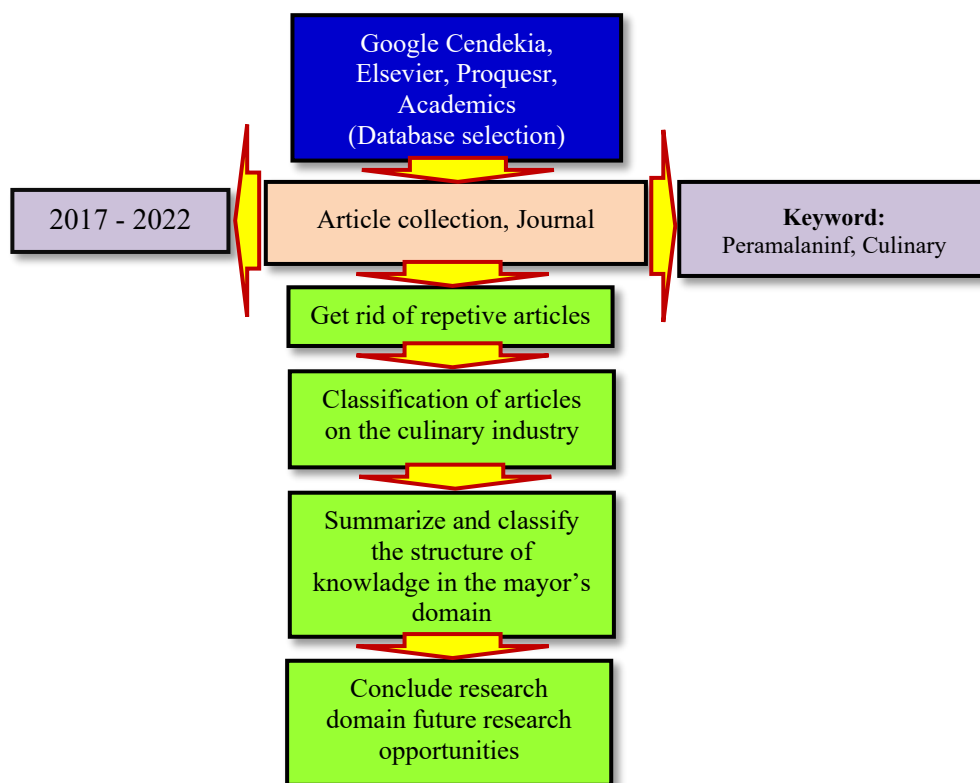


Figure 1. Systematic Review Methodology  
Source: (Dikanom, 2020)

#### 4. Data Collection

Based on all the journals and articles studied, the researcher compiled and divided 40 journal articles on the topic of the effectiveness of simple time series forecasting into six groups sorted by year of publication from 2017 to 2022 which is depicted in the following Figure 2:

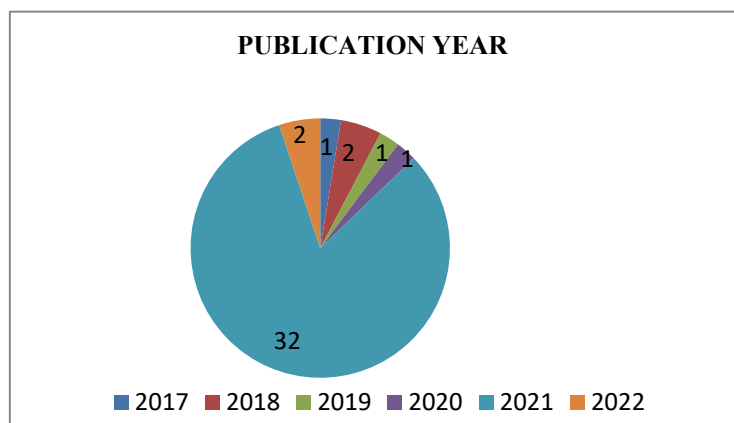


Figure 2. Publication Year

Journal research taken by researchers a total of 40 journals, on in 2017 a number of 1 journal, on in 2018 there were 2 journals, in 2019 there were 1 journal, in year 2020 has 1 journal, on this year 2021 of 32 journals (Angela, 2022). This means that in 2021 this is at most compared its another year especially in 2022 have journal a total of 2 journals. Interpretation journal this optimized researcher by direct to distant development more optimal and appropriate (Andreas, 2018). Through the diagram above, in 2017-2022, several journal articles used a research method in the form of a systematic literature review (SLR) (Figure 3).

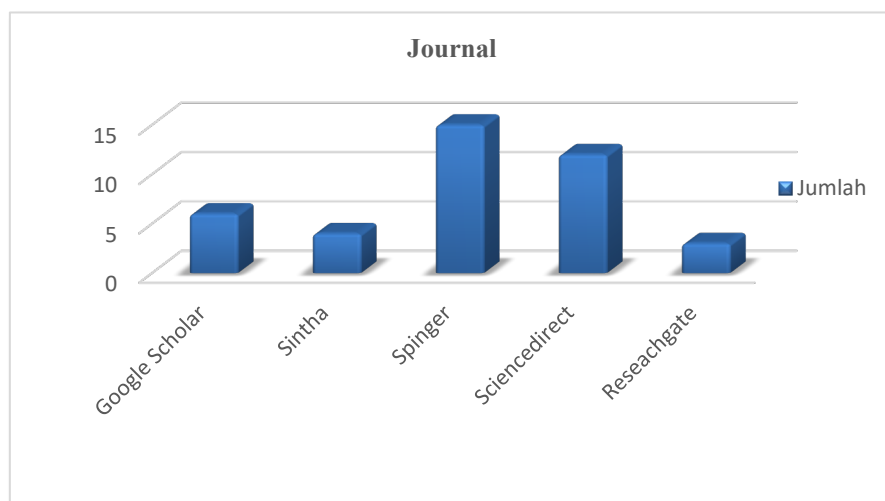


Figure 3. Quantity Journal

Based on the diagram above showing that spinner is reference most journals used in Research System Literature review because contents from journal that is relevant. The SLR method is used for research that focuses on ongoing problem analysis to obtain a more complete information structure, so that it can produce systematic, explicit, and reproducible research to facilitate researchers in identifying problems, evaluating, and synthesizing published scientific works. previously made by previous researchers (Angela, 2022).

## 5. Results and Discussion

### 5. 1 Simple Time Series Forecasting Process in the Culinary Industry

In forecasting techniques there are many methods that can be used in the forecasting process with different data patterns. Forecasting methods based on the use of analysis of the relationship pattern between the estimated variables and the time series variables are the smoothing method, the Box Jenkins method, the trend projection method with regression (Nia, 2019). This is also applied to the culinary industry where the time series forecasting method is able to provide certainty in the interpretation of the use of time series forecasting methods in the culinary industry (Abigail, 2020). Forecasting results in practice are almost never completely accurate (Angela, 2022). This is due to uncertain future circumstances and events (Belinda, 2021) However, if all the important influencing factors have been taken into account and the model of the relationship between these factors is well defined, then the forecasting results will be close to the actual conditions, so care must be taken, especially the selection of the method to be used. in certain cases (Naomy, 2019). This is considered because there is no one forecasting method that can be used universally for all circumstances or situations including demand, supply, buying and selling. (Dante, 2020)Referring to previous research conducted by (Ariel, 2021), in the simple time series forecasting method in the culinary industry, it is stated that in the case of the culinary industry, seasonal factors and short durability factors are limitations in managing inventory, which requires forecasting with a high level of accuracy. tall (Nano, 2022). In the case presented, the application of the product demand forecasting method in the food industry that carries out direct sales and production planning time is in the short to medium term. Previous forecasts were evaluated using the MAPE error measure and compared with the current demand from the culinary industry (Bernad, 2019). As with the approach to management decision making, in forecasting there are two general approaches that can be used, namely quantitative or qualitative methods (Sheren, 2020). In fact, a combination of the two is the most effective combination (Antonyio, 2019).

### 5. 2 Effectiveness of Simple Time Series Forecasting Methods in the Culinary Industry

The concept of Time Series is divided into two, namely Time Series Analysis and Time Series. Analysis focuses on understanding the existing data set. Here, we focus more on determining trends, relationships with external factors, etc. (Bobby, 2019) In essence, we just want to add insight into the existing data, and that's about it

(Gideon, 2020). Forecasting takes a step further, namely predicting future events, from the insights we get, from a series of events that have occurred we can calculate future events, this is certainly very useful because with this we can do many things, such as anticipating what will happen next. will occur. will come in the future (Reynold, 2021). The time series method is a forecasting method using the analysis of the relationship pattern between the variables to be estimated and the time variable (Antonyio, 2019). Forecasting time series data needs to pay attention to the type or pattern of the data (Sezer, 2020). In general, there are four kinds of time series data patterns, namely horizontal, trend, seasonal, and cyclical (Aktepe, 2021). Horizontal patterns are unexpected and random events, but their occurrence can affect fluctuations in time series data (Roy, 2021). A trend pattern is a trend in the direction of data in the long term, it can be an increase or decrease (Hamdan, 2021). Seasonal patterns are data fluctuations that occur periodically within a year, such as quarterly, quarterly, monthly, weekly, or daily (Reynold, 2021). While the cyclical pattern is the fluctuation of data for more than one year. but their occurrence can affect fluctuations in time series data. This involves the number of forecast smoothing whose effectiveness has been identified since the 2017-2022 analysis (Zom, 2022). The data below shows that the effectiveness of the time series forecasting model that is carried out comes from the movement of the Moving Average from what has been set in the form of monthly or yearly which results in the existence of simple moving averages and averages. exponential moving average. The interpretation of the data is based on the average usage of both sales and purchases, demand and supply related to simple time series in the culinary industry as follows (Bendana, 2020):

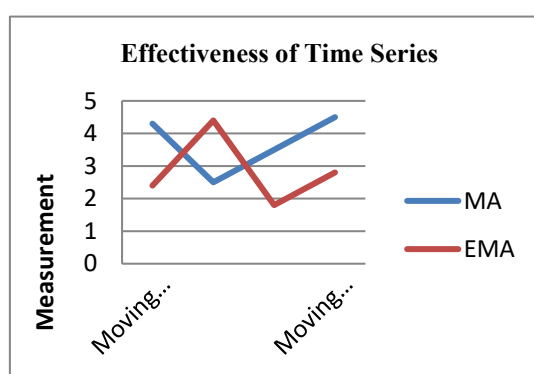


Figure 4. Forecasting Effectiveness of Simple Time Series Culinary Industry (Moving Average)  
Source: (Naomy, 2019)

From the graph of the effectiveness of the application of simple time series forecasting in the culinary industry (Figure 4), it can be seen that there is a Moving Average intersection, namely the effectiveness of forecasting methods carried out in the culinary industry within a certain time span from 2017 to 2022 has received the last year so that it is effective. Two times looking at the intersection of the moving averages and also the exponential movement shows that the forecasting effectiveness has reached 3.5% and 3% in the last 5 (Bilah, 2020) years. (Lili, 2020). The existence of this forecasting is a form of development of the method used in a system from a simple time series method which will later provide forecasting interpretations that the existence of this method is one of the most important things in doing a forecast (Andreas, 2018). structured planning or forecasting so as to provide an analysis of development patterns where this application is a form of effectiveness in forecasting the existing culinary industry (Avan, 2019).

### 5. 3 Calculation of Simple Time Series Forecasting Methods in the Culinary Industry

In the culinary industry, the company uses a good forecasting system for sales, purchases, supply and demand with a simple time series forecasting method, where the company has succeeded in reducing preparation costs and production inventory costs by 23% (Reynold, 2021). So that the impact of using long-term scheduling can reduce production operational costs. company. In other manufacturing industry research, especially in electronics companies, companies use the Palmer method as part of a long-term scheduling system (Giacinta, 2021). Through the implementation of long-term scheduling, companies can prioritize product delivery according to the specified due date and ensure products can be distributed to customers on time. Thus, providing efficiency and effectiveness in the production process carried out (Homigas, 2021). In calculating this forecasting method, (Beri, 2020) therefore, the use of SMA is the best time series method in predicting simple time series in the culinary industry as follows (Deno, 2022):

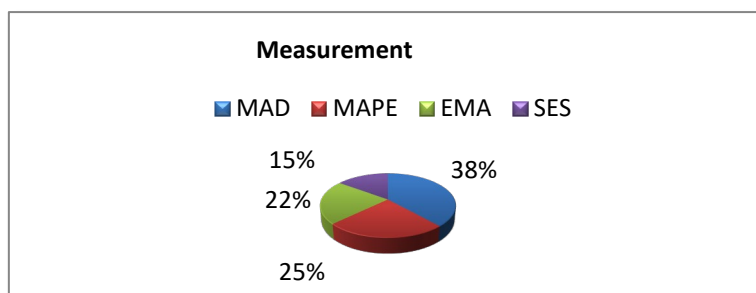


Figure 5. Overview of Simple Time Series Forecasting Calculations  
Source: (Sheren, 2020)

The data was obtained from 2017 to 2022 which shows the calculation that the volatility of the culinary industry shows the calculation of MAD 38%, MAPE 25%, EMA 22% and SES 15% (Figure 5). If the MAD movement has a high accuracy value, this indicates that the full costing method has a fairly good accuracy (Angela, 2022) compared to the simple moving average, thus creating an analytical concept that with the application of this forecasting the culinary industry can be more advanced (Sheren, 2020). Perspectives on forecasting may be as diverse as any other group of scientific methods (Seker, 2021). The company always sets goals and objectives, tries to estimate environmental factors, then determines the actions that are expected to result in the achievement of these goals and objectives (Loly, 2020). This study discusses the forecasting model for the selected culinary industry (Anine, 2020). Because forecasting in the culinary industry in 2022 has increased quite well (Grace, 2021). Smoothing bases its predictions on the principle of average past error (Averaging smoothing past error) by adding the percentage of the previous prediction error (percentage of past error), which is obtained from the difference between the actual value and the predicted value (Gideon, 2020). The decomposition bases its predictions by dividing the time series data into several components which will then combine the predictions of these components (Richard, 2019).

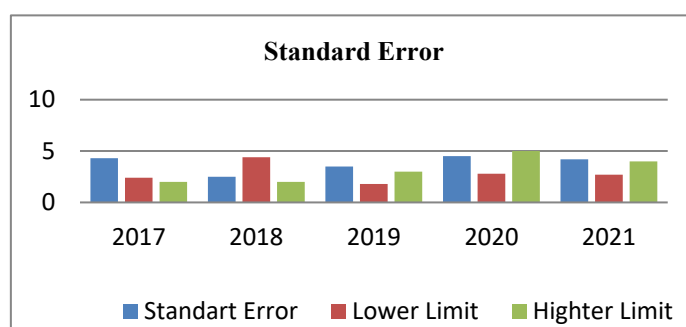


Figure 6. Standard Error Simple Time Series  
Source: (Andreas, 2018)

From the interpretation of the data (Figure 6), it shows that the range from 2017 to 2021 has a sampler error which is calculated through the existence of a structured development concept where in this case the interpretation of several time series shows that there is a forecasting relationship that has a (Roy, 2021)structured development to be one of the most important things to improve, not only that, in the development process it requires a form of system which is one of the most important and highest forecasting since 2020, 5 of these calculations, the index is one of the most important things to be implemented comprehensively. intact (Lula, 2020). Time series analysis is based on the assumption that the time series consists of components of Trend/Tendency (T), Cycle/cycle (C), Seasonal Pattern (S), and Random Variation (R) which will show a certain pattern (Antonyio, 2019).

## 6. Conclusion

Forecasting is a prediction about what will happen in the future. Companies that produce manufactured goods require raw materials, just as the culinary industry requires raw materials in its production process. In meeting the needs of raw materials, forecasting is needed. From the understanding of the experts above, it can be concluded that forecasting is the art and science of predicting future events by conducting a study of historical data to find

systematic relationships, tendencies, and patterns. Forecasting in the culinary industry is very important. obtained that SMA has the smallest error rate in forecasting. Therefore, the use of SMA is the best time series method in predicting simple time series in the culinary industry.

## 7. Suggestions

Forecasting results are said to be biased if the forecast is too high or low compared to what actually happened. Forecasting results are said to be consistent if the magnitude of the forecasting error is relatively small. Forecasting that is too low will result in a shortage of inventory, so that consumer demand cannot be met immediately as a result the company can lose customers and lose sales profits. Forecasting that is too high will result in a buildup of inventory, so that a lot of capital is absorbed in vain. Judging from the accuracy of the calculations in time series forecasting with calculations from 2017 to 2022, this forecast must have a high level of accuracy in MAD so that the culinary industry is able to forecast demand.

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