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AN OVERVIEW OF FORECASTING METHODS: AN APPLICATION FOR AN APPAREL-TEXTILE FIRM IN THE PRODUCTION SECTOR

TAHMİN YÖNTEMLERİNE GENEL BAKIŞ: ÜRETİM SEKTÖRÜNDEKİ BİR TEKSTİL FIRMASI İÇİN UYGULAMASI

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ABSTRACT

The forecasting events are the art and the science. Early humans forecast the available food before considering where to choose on a specific day, and before deciding whether or not to invade a area, the Romans predict the strength of the armies. Today farmers predict the weather before deciding whether or not to plant a particular day and before deciding about their schedules for a semester students predict the difficulty of the courses.
Demand forecasting is critical as it leads from the preparation, staff, development and procurement of materials through to promotion and delivery across other areas of a organization. Far from forecasting demand, activities, commodity shortages, excess inventories and late deliveries can contribute to over or understaffing. In comparison, accurate market forecasts will result in goods being launched in good time, factories can be opened up and their revenues will rise. Organizations predict many different phenomenons, including interest rates, market share and prices, than product requirements. The basic goal of estimating demand is to make good determinations-forecasting about the company's future. Various forecasting methods and models are suggested within the scope of the study, and literature studies are presented. This research discusses these issues: demand projections, the monitoring mechanism for sales forecasts and a viewpoint on how estimates are produced and calculated. For the application of the study, the forecasting models are applied for the textile-apparel firm (ABC Company) and these models are compared according to the measures of Accuracy. The most convenient-appropriate forecasting method-model was developed for volume of sales of ABC company-plant. It is investigated how the sales forecastings (volume of products) made for the company affect the inventory level and costs. In this way, forecastings are made in terms of directing the business plan and mission for the future of the company. ABC Apparel company is having frequent introductions of new products as it produces fashion-based wears. Although they can forecast the total sales, these frequent introductions reduce the lifetime of the products and make it difficult to predict at product level. According to this issue, the aim of this research is to find out a method for forecastin model and implementing it to the firm.

Key Words: Forecasting Methods, Sampling Model, Textile-Apparel.

ÖZET

Tahmin, gelecekteki olayları tahmin etme sanatı ve bilimidir. İlk insanlar belirli bir günde nerede avlanacağına karar vermeden önce yiyeceklerin mevcudiyetini, mikatrını tahmin ederler ve Romalılar bir bölgeyi istila edip

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etmemeye karar vermeden önce orduların gücünü tahmin ederler. Günümüzde çiftçiler belirli bir günde bitki dikip dikmeyeceğine karar vermeden önce hava koşullarını tahmin ediyor ve öğrenciler bir dönem için programlarına karar vermeden önce derslerin zorluğunu tahmin ederler.
Talep tahmini önemlidir, çünkü bir kuruluşun planlama tesislerinden, personelden, üretimden ve malzeme alımından pazarlama ve dağıtıma kadar birçok yönünü yönlendirir. Hatalı talep tahminleri, operasyonların, ürün eksikliklerinin, fazla stokların ve geç teslimatların aşırı veya yetersiz kalmasına yol açabilir. Aksine, doğru talep tahminleri ürünlerin zamanında tanıtılmasına, tesislerin açılmasına ve böylece kârlarının artmasına yol açabilir. İyi tespitler yapmak-şirketin geleceği hakkında tahmin etmek, talep tahmininin temel amacıdır. Çalışma kapsamında çeşitli tahmin (nitel) yöntem ve modeller önerilmiş ve literatürden çalışmalar sunulmuştur. Bu çalışma şu konuları içermektedir: satış tahminleri, satış tahminleri kontrol süreci ve tahminlerin nasıl yapıldığına ve belirlendiğine dair bir perspektif. Çalışmanın uygulanması için tekstil-giyim firması (ABC işletmesi) için tahmin modelleri uygulanmış ve bu modeller doğruluk ölçütlerine göre karşılaştırılmıştır. En uygun-uygun tahmin yöntemi-model ABC işletmesinin satış hacmi için geliştirilmiştir. İşletme için yapılan satış tahminlerinin (ürün hacmi) envanter seviyesini ve maliyetlerini nasıl etkilediği araştırılmıştır. Bu şekilde şirketin geleceğine yönelik iş planını ve misyonunu yönlendirmek amacıyla tahminler yapılır. ABC Giyim işletmesi, modaya uygun giysiler ürettiği için sık sık yeni ürünlerin tanıtımını yapmaktadır. Toplam satışları tahmin edebilseler de, bu sık yapılan tanıtımlar ürünlerin ömrünü kısaltır ve ürün düzeyinde öngörmeyi zorlaştırır. Bu konuya bağlı olarak bu araştırmanın amacı, firmayı öngörmek ve uygulamak için bir yöntem bulmaktır.

Anahtar Kelimeler: Tahminleme Yöntemleri, Örnekleme Modeli, Tekstil-Konfeksiyon.

1.Introduction

Forecasting is the art and science of predicting future events. As markets and businesses have become larger and more complex, and as change occurs faster, the time frame for decision-making has increased, and the consequences of making poor decisions have become more serious. The forecasting method therefore needs to become more structured, reliable , and efficient. The purpose of making forecasts is to use these as inputs into some decision-making process, either explicitly or implicitly (Bowerman and O'Connell, 1987; Box et al., 1994; Ramo and Sugar, 2009).

The fundamental aim of demand prediction is to make decisions with a predictive view of the company's future. Diverse forecasting methods and models are suggested and literature studies are described within the scope of the research. This study contains the following problems: sales forecasting, sales control and an insight into how forecasts are constructed and ascertained. Also, one of the objectives of the forecast research is to decrease the high losses and inventory obsolence by determining the products with high lead times and shortening the lead times. For the application of the study, the forecasting models are applied for the textile-apparel firm (ABC Company) and these models are compared according to the measures of Accuracy. The most convenient-appropriate forecasting method-model was developed for volume of sales of ABC company.

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By the rapid development of the technology, all firms, independent of their industry are now able to develop new products in shorter times. They can also manufacture wide variety of products precisely and rapidly by the flexible manufacturing systems. Consequently, consumers are served with unprecedented number and variety of products. But this makes it more difficult for manufacturers and retailers to predict which of their products will sell and to plan production and orders accordingly. Therefore, inaccurate forecasts are increasing. At the end of season both manufacturers and retailers are facing with more unwanted products in their stocks, which will, most probably, be marked down. In addition to this they lose potential sales because of stock outs. Stockout and markdown costs can exceed the total cost of manufacturing in industries like fashion apparel as it has highly volatile demand (Macchion et al., 2015; Martinich , 1997; Fisher et al., 1994; Fisher and Raman, 1994).

Managers employed different production scheduling systems in order to cope with the problem. At first they used quick-response programs, just in time (JIT) inventory systems, manufacturing resource planning (MRP), and the like. These tools are beneficial within the company, it is easier and least costly to change production schedule with those tools, but they do not contribute to the supply chain. That is, if a purchase order is released, there is no way to cancel it. Manufacturers can eliminate the need for forecasting by producing in direct response to demand But this seems almost impossible. As sales of volatile products, for many industries, occur in a concentrated season firms should have unjustifiably large capacity to produce in direct response to demand. Of course, this is the case for companies that are not dependent on suppliers. Industries, such as apparel industry, are heavily dependent on their suppliers, with relatively long lead times (Macchion et al., 2015; Martinich , 1997; Fisher et al., 1994; Fisher and Raman, 1994).

An correct response, both businesses and retailers can minimize the costs of forecasting mistakes by taking a modern approach to the entire forecasting, preparation and manufacturing cycle. Accurate response groups products into two, products whose demand is relatively predictable and products with unpredictable demands. Firms, than, are now able to employ different manufacturing philosophies for each class of product. In the beginning of the production period small amounts of unpredictable items and those predictable ones should be manufactured to reserve greater manufacturing capacity for those unpredictable ones. Early season sales are used to determine which of unpredictable products should be manufactured additionally. Thus, accurate response enables firms to use their flexible manufacturing systems and short cycle times more effectively and efficiently (Macchion et al., 2015; Martinich , 1997; Fisher et al., 1994; Fisher and Raman, 1994).

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ABC Company is an apparel firm serving in children and adult market with wide variety of products. It is one of most rapidly developing firms in Turkey. With its foreseeing top management it grows day by day. They have decided to implement accurate response approach in the company. As it is stated above, accurate response starts with grouping the products as predictable or unpredictable. This business has frequent introductions of new products as it produces fashion-based wears. Although they can forecast the total sales, these frequent introductions reduce the lifetime of the products and make it difficult to predict at product level. It is the aim of this study to find out a method for predicting and implementing it to the firm.

2. Evaluation of the Objective of the Study

The research comprises to investigate how the sales forecasting (volume of products) made for the company affect the inventory level and costs. In this way, predictions are made in terms of directing the business plan and mission for the future of the company. ABC Apparel Company is having frequent introductions of new products as it produces fashion-based wears. Although they can forecast the total sales, these frequent introductions reduce the lifetime of the products and make it difficult to predict at product level. According to this issue, the aim of this research is to find out a method for forecasting and implementing it to the firm. In this way, forecasting according to the sales predictions (volume of products) are made in terms of directing the business plan and mission about the sustainability of the environment for the future of ABC Apparel Company.

If a apparel study is to be carried out, the concept of green apparel must still be decided to make quite clear. The dictionary specifies that the phrases is derived from the Latin word evaluation of the data-to organize; however a wider social interpretation than that of weaving must also be recognized, since it is only one of the diverse options to make textile fabrics. The fact that a garment is now widely recognized as a cloth produced from natural fibers is sufficient, but fibers can be initially converted into yam, and yams can also be assembled in a range of different of specific way, or significant positive fibers into a cloth. As mentioned in the actual world, the garment following specific to phases in the conceptual phase plus a ready-made phase. This description includes content for clothes such as fur, silk, denim, and wooden boards that are unsupported. The only first three are organic and fiber products, while fibers may be removed from the skin and used as silk fibers as hair. Leather and patent leather are rubbery, but the fibers have really no multiple processes. Identity has little quality of fibers at alI in a cloth context except plastic sheeting. In clothing systems and in blends of textiles and synthetic products, fur, leather and patent leather may be represented (Morgan

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and Birtwistle, 2009; Macchion et al., 2015; Martinich, 1997; Fisher et al., 1994; Fisher and Raman, 1994).

Apparel is an industry where considerable stages of the generation of household members under a single politician have been developed much more or less parallel to this supply in industrial-technical, formally organized organizations. Improving and producing new products to meet consumer demand finds ways to produce these products. Moreover, the relative frequency via which modern goods are defined has accumulated (so-named 'fast fashion') and the consuming - using up of garments in the industrialized lands-cities-locations have become larger. Manufacturers must decide what raw materials to buy and what fabrics to manufacture. Manufacturers base their decisions on careful studies of what customers want. People who study fashion changes and consumer demands and use forecasting. Sale is the last step in the marketing process. Textile sales associate show fabric samples to clothing manufacturers (Morgan and Birtwistle, 2009; Macchion et al., 2015). Apparel is one of the basic necessities of human civilization along with food, water and shelter. The apparel sector and the textile industry is real dealt out and various sector with a universal framework in large stages of the industry, where producing and consuming appear in various locations-places and sometimes various subcontinents. The apparel goods chain structure circular from the generation of raw matters (fibres). This growing consumption has become parallel-collateral with differences in the development policies in the apparel sector approaching what is named 'fast fashion‘. Apparel Production Segment includes all people and processes involved in designing and making garments (Morgan and Birtwistle, 2009; Macchion et al., 2015).

This study is implemented in ABC Apparel-Textile Company in Marmara Region, Turkey. Forecasting the Volume of Production-sales (VoAP) and sales are basic-fundamental requirement for the sustainability and the strategically vision of the ABC Apparel-Textile Firm. In this objective, Demands of consumers according to ABC Apparel-Textile Firm-Factory –VoAP could be supplied on time and sales can be sustained and production can be developed with the minimum stock. Process Sequence of Apparel Manufacturing of this company is presented as below in Figure 1.

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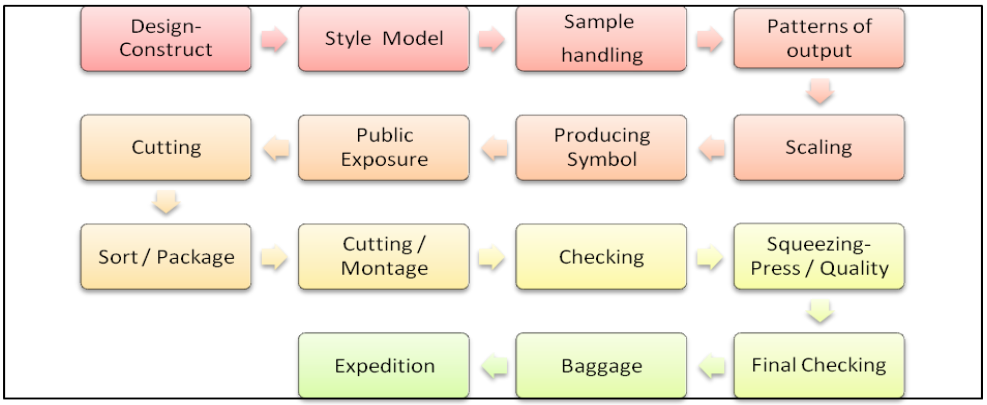

Figure 1. Process Progression of the Manufacturing of Apparel (ABC Apparel Company)

These developments could decrease the manufacturing and holding cost particularly. Forecasting technique is a tool that ABC Apparel-Textile Firm can have competitive opportunity-advantage in the environment of the market. Volumes of Production-sales are implemented to observe whether distributions of the volume of the production-products can fit via a forecasting model or not.

The data studied is the total of the actual production-sales from recycling. The concept of forecasting and literature of this issue are presented firstly, before the application of the forecasting technique for the volume of the production-products according to the data of the firm.

3. Forecasting and Time Series

The time series is the order of the date, which is particularly adjusted for a uniform-consistent time disruptions. Samples continue indefinitely in a classification of scopes in each topic from financial to engineering, and the approach to time series analysis is an important issue of statistics. In other words, a time series is a list of the sequential and periodically separated factors that arise in time. Tehnic forecasting of time series evaluation provides a significant statistical scope. However, this topic has many more destinations that could be helped by considering a time series, such things may be categorized as forecasts, projections, controls or meanings, descriptions (Bowerman and O'Connell, 1987; Makridakis et al.,1998; Ramo and Sugar, 2009).

Time series assessment continues to support modeling access, which includes only data on the variables shaped, in order to protect the researcher from the complexity of analyzing the

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effective variables and to provide a framework for the integration of the variables. Univariate Box-Jenkins analysis (Box and Jenkins, 1976) – Methodology has generally been used for modeling and predicting with much more development (Box et al ., 1994; Makridakis et al., 1998; Ramo and Sugar, 2009; Albayrak, 2010; Green, 2011).

The prediction provides executives and decision-makers with logical conclusions. One of the most crucial steps on how well the model executes is how well it predicts. In order to generate dynamic forecasts, the method includes either variable lags or error conditions to be included (Sanders and Reid, 2012).
Steps in the Forecasting Process (Ramo and Sugar, 2009; Sanders and Reid, 2012; URL, 4):
The following forecasting method consists of five basic steps:

1- Determine the prediction objective and when it would be appropriate to use this technique. This can be proof of the degree of the prediction, the amount of resources that can be generated and the degree of precision.

2-Deploy a time horizon trend that the forecast needs to overlap, given that the accuracy value is reduced as the time horizon increases.

3- Pick a tool for forecasting.

4-Collect and analyze pleasant data and then set the forecast. Description and use of the forecast of any assumptions that are given with the relation.

5- Follow the prognosis for an appropriate analysis to assess whether it is carried out. If not, revise the methodology, hypothesis, and data covertness and so forth, change the revised forecast, as needed.

For forecasting techniques for the volume of Production-sales (VoAP) data from ABC Apparel-Textile Firm in time series model applications, various methods may be implemented. In general, the predictive analysis consisted of multiple regression, a decomposition model, three exponential smoothing parameters for winters, and ARIMA. However, Minitab Software has improved the degree and pattern parameters of the Winters Process and Decomposition Model.

4. Forecasting Model for the Application

4.1. Regression Analysis

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Regression analysis is a statistical research based on a mathematical model and designed to analyze and forecast the relation between two or more economic variables using a multiple regression analysis (Aşıkgil, 2006; Bickici, 2007).

Regression is most commonly defined as the process of analyzing the relationships between variables and their connections. Regression analysis considers the degree to which one or more variables influence one or more variables in the other. If the variables are connected, the next step is to decide the degree of the relationship and its functional type. In other words, regression analysis estimates the possible values of the dependent variable based on the values of the independent variables in a model that is created by predicting unknown parameters (Bakın, 2007).

This technique applies a pattern to a number of historical data points and then leads to the next period for longer-range forecasts.

Curve Fitting: Multiple Regression

Two or more independent variables are used to predict the dependent variable:

$$Y = b_0 + b_1X_1 + b_2X_2 + \ldots + b_pX_p$$

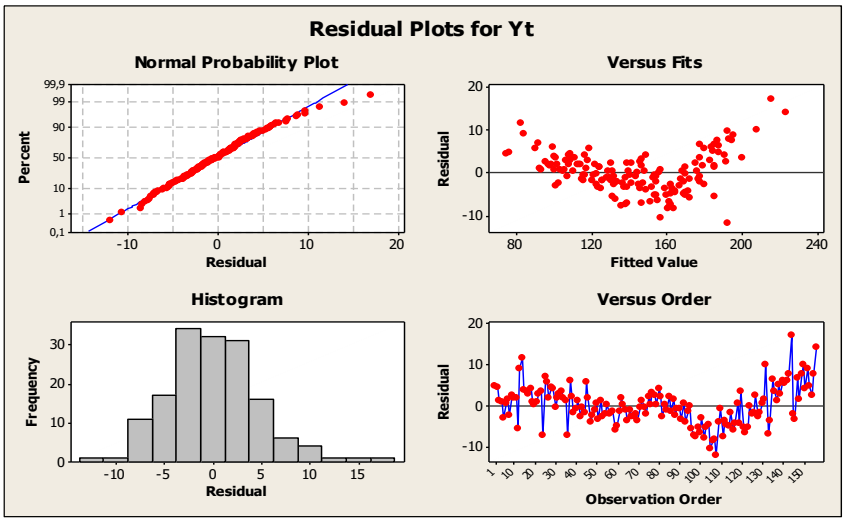

Figure 2. Graphs of Residuals as Four in One for volume of Production-sales (VoAP) data of ABC Apparel-Textile Firm

The distribution ratio of data in figure 2 will accept assumptions of normality of the results including and the predictor variables it produces as the probabilities below are focused.

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Regression Function (*) of this relationship is as follows:

Yt = 123 + 0,644 t - 47,6 D1 - 50,2 D2 - 32,6 D3 - 32,8 D4 - 25,8 D5 - 27,2 D6 - 29,9 D7 - 25,9 D8 - 33,8 D9 - 31,1 D10 - 28,4 D11

The variable depending on the volume of Production-sales (VoAP) data is numerically represented. This chart in Figure 2 has no significant correlation between the residuals and is efficient for the suggested model.

4.2. Decomposition Model

If the enormity of the seasonal fluctuation does not improve with the series Level, an additive model is appropriate. More economically efficient is the multiplying model because the majority of the seasonal economic series involves seasonal adjustments, which increases with the series level (Makridakis et al., 1998; Hanke, 2005).

Decomposition Application actual data for volume of Production-sales (VoAP) data) is analyzed. The seasonal variation showed to be about the same magnitude over time, therefore an additive decomposition may be useful. The plot of a time series is shown in Figure 43.

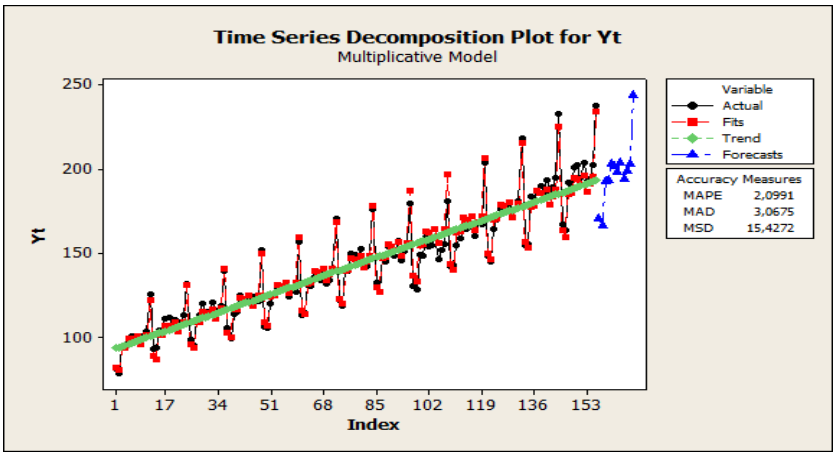

Figure 3. Time Series Decomposition Plot for volume of Production-sales (VoAP) data of ABC Apparel-Textile Firm

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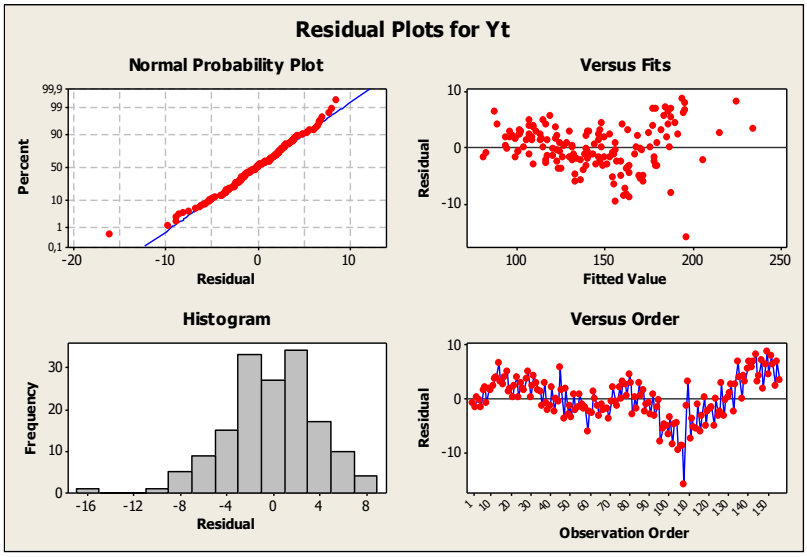

Figure 4. Graphs of Residuals as Four in One for volume of Production-sales (VoAP) data of ABC Apparel-Textile Firm

This graph of figure 4 for Decomposition Model has no significant correlation among the residuals and recommended model is convenient.

4.3. Winters' Three-Parameter Exponential Smoothing

Winters' Smoothing Model expands the two parameter models to the seasonal situation by adding a third parameter to modify for seasonality (Makridakis et al., 1998; Hanke, 2005). The formula is:

$$Y_{t+1} = (S_t + b_t) * I_{t-L+1} + e_t$$

Where;

S_t= Non-seasonal Index for period t+1

b_t= Trend in period t

I_{t-L+1}= Seasonal Index for period t+1

e_t= Error in period t

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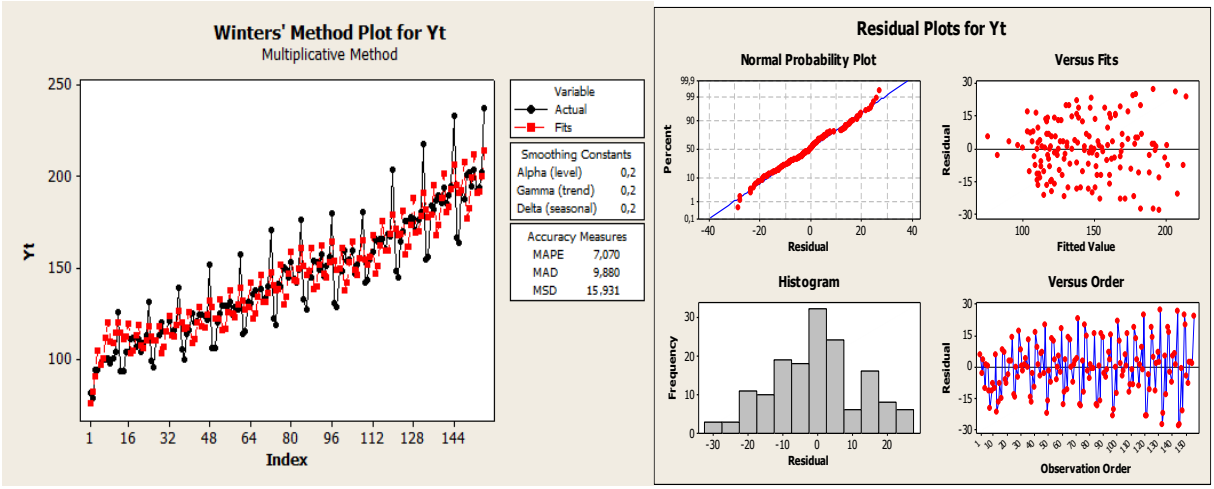

Figure 5. Winters' Method for volume of Production-sales (VoAP) data

Volume of Production-sales (VoAP) data data of ABC Apparel-Textile Firm has the regular variations. It shows a seasonal pattern. Thus, this forecasting technique is applied for this data. It shows a seasonal pattern (see Figure 5).

Winters' Method for Yt

```
Multiplicative Method

Data     Yt
Length   156

Smoothing Constants

Alpha (level)      0,2
Gamma (trend)      0,2
Delta (seasonal)   0,2

Accuracy Measures

MAPE     7,070
MAD      9,880
MSD     15,931
```

Figure 6. Screenshots of Winters' Method via Minitab Output for volume of Production-sales (VoAP) data

The optimum value of parameters (α-level, γ-trend, Delta – see Figure 6) of this method can be discovered via applying the maximum likelihood prediction and minimisation of the sum of the squared errors.

4.4. Autoregressive Integrated Moving Average (ARIMA) Model

The autoregressive built-in motion average (ARIMA) model estimates are a method for assessing the stationarity of the relevant variable and the delay lengths of the ARIMA model with a focus on the ACF (autocorrelation function) and PACF (partial autocorrelation function).

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How well a model works is one of the most significant checks. The ARIMA model is one of the most popular statistical frameworks. The model needs to include either lags of variables or error terms in order to generate dynamic forecasts. Although late length in an ARIMA model is usually determined using ACF and PACF methods, the information criteria can also be used (later covered) Other methods called the information criteria (Pankratz, 1983; Makridakis et al.,1998; Hanke, 2005).

When data from Volume of Production-sales (VoAP) of ABC Apparel-Textile Firm has been collected, there is a trend that is increasing, as is clearly shown in Figure 10(a). That is the data condition that is non-stationary. This form of series could be converted to stationary to enable time series analysis in accordance with the Box-Jenkins technique.

There is no difference in value and tendency after the implementation of the natural logarithm conversion (see Figure 7(b)). Seasonality is also visible. This data is seasonal and have a trend.

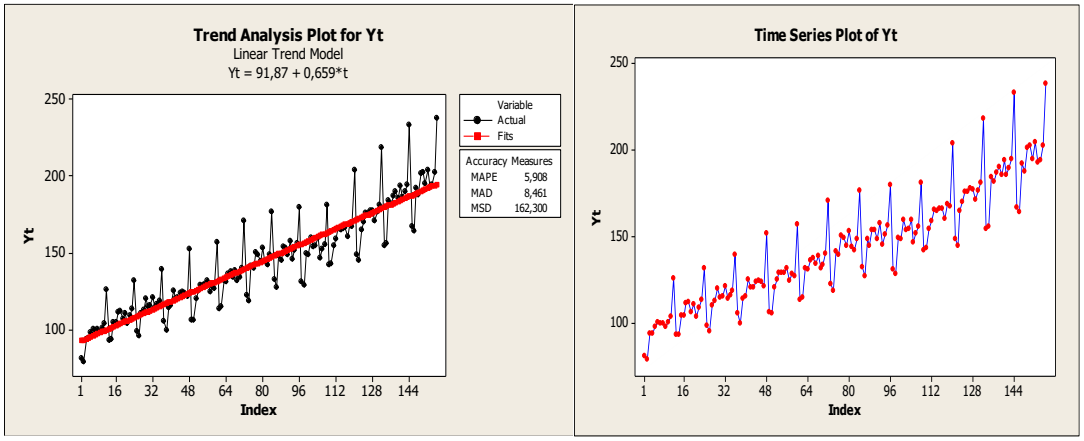

Figure 7. (a) Trend Analysis and (b) Time Series - Natural Logarithm Transformation of volume of Production-sales (VoAP) data of ABC Apparel-Textile Firm

The Auto-Correlation Function plot shows the relationship between the series and itself in different lags. The correlation factor is self-correlation. Furthermore, the correlation between two different variables is between, at times, X_i and X_{i+k}, two values of the same variable (Green, 2011).

The PACF plot displays the quantity of autocorrelation in lag k which is not calculated by low-order autocorrelation. Partial correlation measures the degree of association between

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two random variables, with the effect of a set of controlling random variables removed (Green, 2011).

The trend is eliminated and steadiness is achieved. Figure 8(a) and Figure 8(b) of the graphs of ACF and PACF are also shown severally.

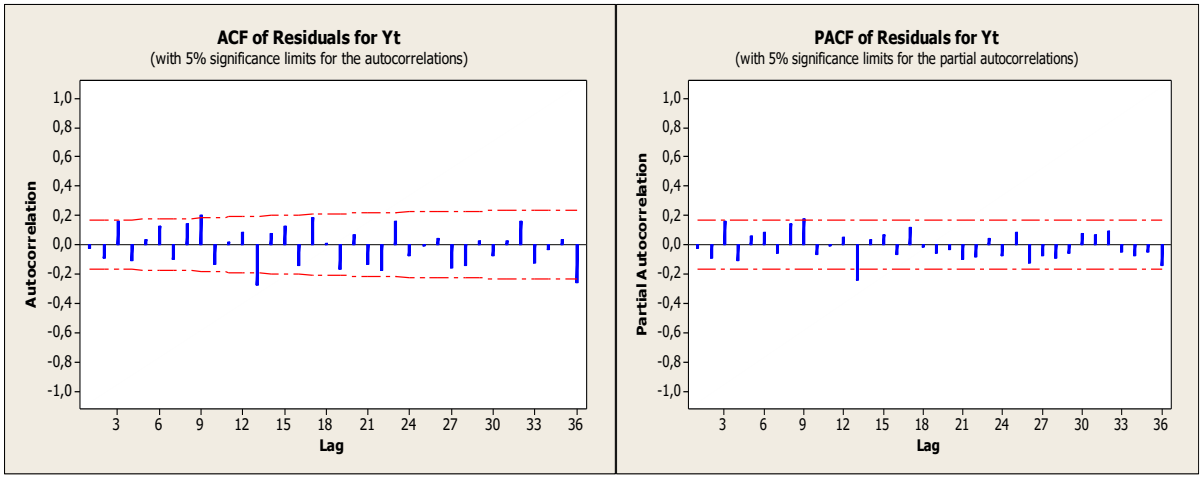

Figure 8. ACF (a) and PACF (b) function graphs of the volume of Production-sales (VoAP) data of ABC Apparel-Textile Firm

Depending on the unit of PACF coefficients, Regulation of autoregressive method of the ARIMA model is completed. The regulation of the ARIMA structure moveable average (MA) by the unit of ACF coefficients is accordingly established. Models are governed on the extreme points of the algorithms and function-formulations (Makridakis et al . , 1998; Hanke, 2005). This approximation is used to study the ARIMA model arrangement. The autocorrelation graph lags of discrepancy 3 in Figure 8(a) are not peaked.

Figure 8(a) is autocorrelation ship transformation charts. The ACF/ PACF charts (Figures 8(a) and 8(b)) can be dealt with together, so that the recommended model could be allowed for SMA(1). Minitab is the successive output generator.

Eventually, to decide if the suggested model is useful to this knowledge and to disobey or map the plots of ACF and PACF of the residuals that are generally supposed to stay in uncorrelated terms of error (see Figure 8(a) and 8(b)). As can be seen from Figure 9, this graph has no significant correlation between the residuals, and it is appropriate to use the data of volume of Production-sales (VoAP).

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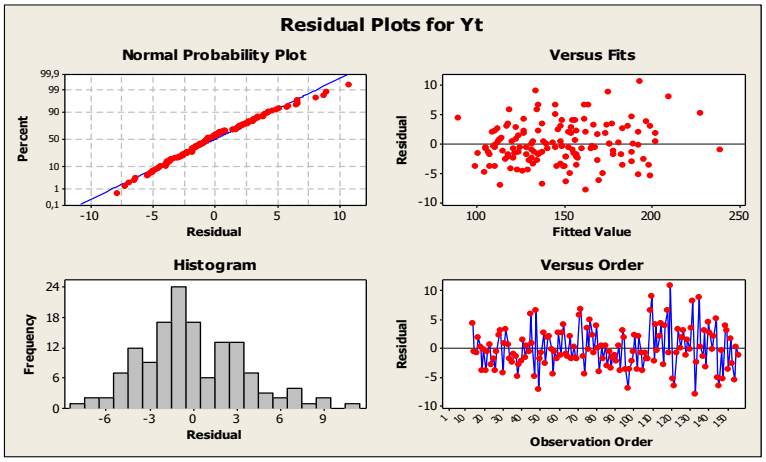

Figure 9. Graphs of Residuals as Four in One for the volume of Production-sales (VoAP) data of ABC Apparel-Textile Firm

The data has been fully modified by using a logarithm using base e to preserve the variance. No differences for the difference of data were observed. The difference was first acquired after returning the logarithm to maintain the data average and to construct a suitable ARIMA model.

ARIMA (0,1,1)(0,1,1) was adapted to the data.

ARIMA Forecasting Formula is ;

(1 - B)*(1 - (B^12))*Y(t) = C1 + (1 - M1*B)*(1 - SM1*(B^12))*E(t)

Y(t) = C1 + Y(t-1) + Y(t-12) - Y(t-13) + E(t) + M1*E(t-1) - SM1*E(t-12) + M1*SM1*E(t-13)

for the constants C1= 0,0061 M1=0,7443, SM1= 0,4488.

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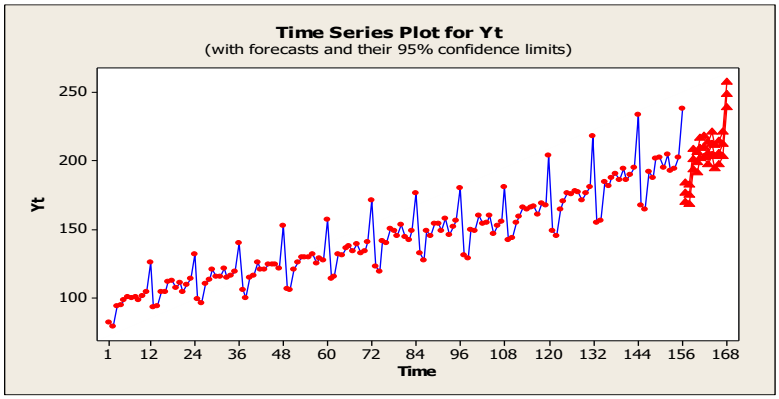

Figure 10. A Perception of seasonally the Volume of the volume of Production-sales (VoAP) data of ABC Apparel-Textile Firm with estimation Upper -Lower Limits

The ARIMA forecast indicates three options, UCL (Upper Control Limits), LCL (Lower Control Limits) and the values predicted in figure 10. In other terms, any comprehension of trust constraints within UCL and LCL is satisfying to maintain a confidence interval of 95 percent. In view of the Production-sales (VoAP) data forecast of ABC Apparel-Textile Firm, we describe the fits to be barely changed for observed data sampled three months-trimesters. The fits were restricted to 169,669– 257,155 for the twelve cycles.

5. Measuring Forecast Error-Types of Measures of Accuracy

The discrepancy of the observed real value and its predicted value is a residual value (Makridakis et al., 1998; Black, 2011; Hanke, 2005).

e_t= the. forecast error in time period *t.*

Y_t= the actual value in time period *t.*

Y'_t= the forecast value for time period *t.*

The metrics used for determining prediction methods are the mean Absolute Error (MAE), the medium squared (MSE) and the MAPE. The following formats are described for measures of precision and specification (Makridakis et al . , 1998; Hanke, 2005; Green, 2011).

(i) MAPE or Mean Actual percentage mistake, assesses equipped time series correctness. This illustrates accuracy such as a proportion.

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$$\text{MAPE}= \frac{\sum\left|\left(Y_t - Y_t'\right)\right| / Y_t}{n} \times 100 \qquad \left(Y_t \neq 0\right) \text{Eq.(1} \quad \left(Y_t \neq 0\right) \quad \text{Eq.(1)}$$

where Y_t equals the actual value, Y_t' equals the fitted value, and n equals the number of observations.

(ii) MAE which measures the accuracy of suitable time series values, contain for Mean absolute deviation-error. (ii) This expresses precision in the same terms as the numbers of errors supported by the information.

$$\text{MAE}= \frac{\sum_{t=1}^{n}\left|\left(Y_t - Y_t'\right)\right|}{n} \qquad \text{Eq.(2)}$$

where Y_t equals the actual value, Y_t' equals the fitted value, and n equals the number of time series data -observations

(iii) For MSE the same split divider is determined, n according to the model , especially as the comparison of MSE values in time series models has been clarified. The MSE portion-scope of a general-common major error-residual estimation is far more sensitive than the MAE.

$$\text{MSE}= \frac{\sum_{t=1}^{n}\left|\left(Y_t - Y_t'\right)\right|^2}{n} \qquad \text{Eq.(3)}$$

where Y_t equals, exist the actual value, Y_t' equals, exists the forecast value, and n equals the term of estimation-forecasts.

Where equals, the true value is exactly, the predicted value exists, and n equal the predicted estimation term. One significant distinction between MSE and MAE is that an MSE evaluation is far more influenced by comprehensive fitting faults than by minor errors (as errors are squared for the MSE measurement) (Makridakis et al., 1998; Hanke, 2005; White, 2011).

Four methods were compared with the MAE, MAPE and MSE values. The MAPE, MAE and MSE values of ARIMA are below their value than other predicted models in Table 1. The

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MSEs are not as strong as those of ARIMA. ARIMA (0,1,1)(0,1,1) is therefore the most suitable predictive model.

Table1. Error values of different models-Comparisons between ARIMA model, double exponential smoothing and Models of Trend Analysis

	MAPE	MAE	MSE
Winters	7,070	9,880	16,5101
Decomposition	2,0991	3,0675	15,4272
Regression	3,0251	3,6117	21,3561
ARIMA	1,8815	2,7315	12,0231

As the values show and ARIMA model is appropriate for the forecasting model. Season s parameter is 12. ARIMA(0,1,1) (0,1,1) has been shown to contain minimum values of MAE, MAPE and MSE, and to include admissible lower and higher limits, according to season-winters, regression and decomposition procedures. To generate long-term forecasts, we propose ARIMA (0,1,1)(0,1,1) model.

6. Discussions and Evaluations

By using Autoregressive model (AR) technique, it is not known if the sequence is stationary. Methodology of Box-Jenkins is both art and science. Time series forecasting is an essential step in the way a model works. Many steps are required to assess the precision of an prediction, typically a number to decide whether the projection is appropriate, even though all errors occur.

The most pleasant forecasted model is selected and the risk is rationally minimized by rising keeping and production costs. Small costs and rates offer low prices and good consumer loyalty. In comparison, if output is met on schedule, consumer loyalty improves. Confident forecasts also endorse comparative weaknesses, weaknesses and capabilities in the world economy for industries and enterprises. A major need for forecasting is the region of product demand. Demand forecastings derive many impacts of a business from planning facilities, personnel production and material acquisition to marketing and distribution

The lost margin was triggered by production costs. The inventory costs were not added to other variables, like customer satisfaction and cost switching. In general, ABC Apparel-Textile Firm supplies a timely consumer order. Moreover, no planned production expenses are ongoing.

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Exceptional facilities such as discount times, festivals or campaigns should exclude the forecasting model. It is how the market and profits of huge numbers rise or decrease. There will be more accurate tests. Due to the fact that, in the present situation, the forecasting model was developed. If the condition varies, the concept must be periodically checked and updated.

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