(REFEREED RESEARCH)

DEMAND FORECASTING WITHOF USING TIME SERIES MODELS IN TEXTILE DYEING-FINISHING MILLS

TEKSTİL BOYA TERBİYE İŞLETMELERİNDE ZAMAN SERİLERİ MODELİ İLE TALEP TAHMİNİ

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ABSTRACT

In this study, the most suitable demand forecasting system is sought by Time Series Models in textile dyeing-finishing mills. This includes Basic Exponential Smoothing Method, Trend Corrected Exponential Smoothing Method and Winter's Models. The study was performed on real data obtained from a chosen textile mill. And, demand was concluded to change mainly with season in Demand forecasting activities of Dyeing-Finishing Mills, but trend corrected demand forecasting method could also be valid for some product groups. Basic Exponential Smoothing method was concluded an unsuitable demand forecasting method.

Key Words: Demand forecasting, Textile, Dyeing-Finishing Mill, Time Series Models, Production Planning.

ÖZET

Bu çalışmada, boya terbiye işletmelerinde Zaman Serileri Modelleri kullanılarak en uygun talep tahmin modeli araştırılmıştır. Bunlar; Basit Üstel Düzeltme Yöntemi, Trend Düzeltmeli Üstel Yöntem ve Winter's modelleridir. Seçilmiş bir tekstil işletmesinden alınan gerçek veriler üzerinde çalışılmıştır. Çalışma sonucunda Boya-Terbiye işletmelerinin talep Tahmininde ağırlıklı olarak talebin mevsimsel değiştiği ancak bazı ürün grupları için Trend yaklaşımlı talep tahminin de geçerli olabileceği görülmüştür. Basit Üstel Düzeltme Yöntemin ise uygun bir talep tahmin yöntemi olmadığı ortaya konulmuştur.

Anahtar Kelimler: Talep tahmini, Tekstil, Boya-Terbiye, Zaman Serileri Modelleri, Üretim Planlama.

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1. INTRODUCTION

Production is the produced value in the simplest sense. In order to realize profitable growth, firms have to manufacture products valuable for consumers, increase their incomes, reduce costs, improve procurement period and increase consumer satisfaction (1). Production planning and Control is the process includes the determination of product quantity to be manufactured and required equipment for production as well as the programming and organization studies that enable the manufacture of products with demanded quality cost on required time, periods and amounts (2). Preliminary planning studies take part in production planning before the planning stage. Demand forecasting and capacity planning are the main components of preliminary planning. Here, demand forecasting could be defined as a study that determines demand level of one or various products for future time series. Demand forecasting plays a critical role in production planning and stock controlling matters (3). No planning could be made without knowing the amount of demand for a product planned to be produced because the required raw material, replacement parts, half product, machinery, labor force and investment are determined according to the planning. The stages of planning could be defined as follows:

(a) time period of production is determined;

(b) economic stock levels are calculated;

(c) demand forecasting is made;

(d) stock levels at the onset and end of planning stage are determined;

(e) and the difference between the stock levels at the onset and end of planning stage are calculated.

The amount to be produced is found within the planning period stage. This amount is distributed between period frames (4). As is seen, demand forecasting study is the planning function of Production Planning and Control (PPC). Different units of business organization take different approaches to demand forecasting. It could be claimed that demand forecasting is one of the main jobs of sales and marketing units in a mid-sized manufacture firm. However, PPC is more involved in the matter in terms of using the results (5). Demand forecasting can be classified considering various criteria like the intended use, product type, and calculation technique. The most frequent of these is the classification by time periods covered by demand forecast. Demand forecast is divided into four groups:

Very short term forecasts: They are made on daily or weekly basis. They are performed to control pieces, material and product stocks or to prepare assembly-line work programs. Mainly internal data are used.

Short term forecasts: They aim to determine the most suitable party size for product, procurement times and order sizes. Generally, they cover three- or six-month periods.

Mid-term forecasts: It includes the complex production activities of product purchase with indefinite or long procurement time and stock planning of products with seasonal fluctuation. They span six months to 5 years.

Long term forecasts: They aim to provide information on subjects related to investment planning like the purchase of new machinery and extension of mills. They are made for 5 years or longer periods.

The number of factors effective on the result increases in parallel with the time period covered by demand forecast and the relations between these factors become even more complicated. It would be a more correct approach to make forecasts based on data for predicting the behavior of demand instead of beliefs and good-faith approaches (7). Every detail should be given importance for an accurate forecast. However, authenticity of forecasts gains importance as the prediction period gets shortened. The length of period between the moment when demand begins to flow in and the required delivery date reveals the necessity for demand forecast. Adoption of stoking approach to meet consumer demands further increases the importance of demand forecast. Procedures of demand forecasting;

1) Data necessary for forecasting are collected and prepared
2) Demand forecasting period is determined.
3) Forecasting method is chosen and error calculation is made.
4) Validity of forecasting results is examined (8).

The most preferred current demand forecasting methods are cited below (9).

Mean demand: The mean demand consists of determining the arithmetic averages of all past data.

Weighted means: It is based on attributing weights to certain selected periods (generally the last 3 months) and can be calculated as follows:

$X=aD+bD_1+cD_2$

Where, D=demand of the last month (present month), D_1=demand of earlier month, D_2=demand of two month earlier. *a*,*b*,*c* values indicate the importance levels given to months. Accordingly, a+b+c=1.

Exponential weighted means: This technique represents the data of all past values, but gives more importance to data in the recent period. The method is formulized as follows:

$S_t=S_{t-1}+a(D_t-S_{t-1})$

Where, S_t is the demand forecast made at t moment for (t+1) period; at the same time, it is defined as corrected value and this method is called exponential smoothing. D_t is the real demand at t moment, S_{t-1} is the demand forecast made at t-1 moment for t period, while a is the smoothing coefficient. Exponential smoothing is a weighted mean method giving different weights to all past values. A smoothing coefficient changes between 0 -1, and the values close to 1 indicate that the recent values are given more importance.

Moving averages: This method is used to partly eliminate the changes caused by random factors.

Trend (tendency) analysis: This method is preferred for constantly increasing or decreasing forecasts. The difference between two successive periods is known as tendency (10).

Textile mills mainly adopt strategies to protect their potential customers; therefore, they recognize their customers and predict their demands based on experience and intuition or make forecast by average demand method based on sale of a definite product group for a certain period of time (3 months/years). However, demand is not stabile in textile sector and affected by seasonal effects and factors like trend. The most important issue that should be considered in demand forecasting is the tendency of demands for fashion (trend) and seasonal changes. For instance, velvet is produced in summer months in enterprises though it is mainly used in winter months. In other words, the demand for velvet production reaches its maximum level in summer period, while it is close to zero in other periods other than exceptions. For this reason, the essential thing in textile sector is to accept the instability of demand.

Textile and ready-to-wear clothing sector is quite important for export and employment in manufacturing industry. The main stages between raw material and product in integrated textile industry are shown in Figure 1. Dye-finishing mill is the last unit where the textile products are processed. Here, certain processes are performed to improve appearance parameters like dye, press, brightening; attitude parameters like hardening, lubrication; and usage parameters like easy-ironing, power save, non-shrinking. These parts of integrated textile mills should be given utmost importance due to the existence of complex processes, difficulty and high costs of wrongly applied processes. Complexity of the production entails production planning. Production planning, sale forecasting and determining marketing policy in textile mills are important activities for production management. The primary requirement to succeed in these activities is to obtain data from reliable sources. During optimization studies in production planning, real values of many data are wither known or calculated. Demand value is a predictable data type as it involves future and unrealized data. The success in demand forecasting directly affects the success in production planning.

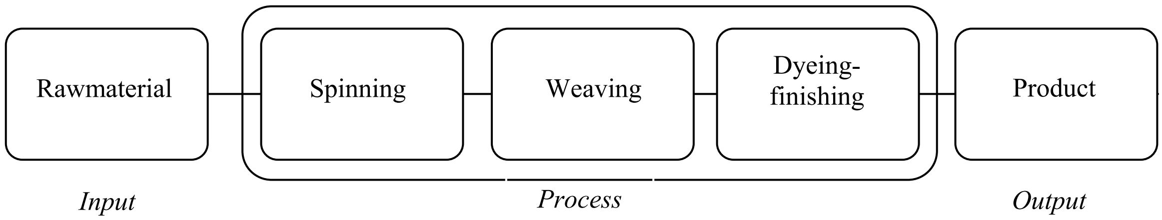

Figure 1. Process flow in integrated textile production

Previous studies are based on forecasts using experience and intuition and demand method. Textile mills mainly adopt strategies to protect their potential customers; therefore, they recognize their customers and predict their demands based on experience and intuition or make forecast by average demand method based on sale of a definite product group for a certain period of time (3 months/years) (3). However, forecasts can be also made considering the effects of trend by months/years or seasonal changes. Metters examined the production/inventory problems under stochastic season demands. In the study, a system of 12 periods was used. It was concluded that demands were stochastic and time dependent, but independent of periods (5). Demand input is a major component in stock control and preparation of product plans. For this reason, due importance should be given to this matter as realistic demand forecasts provide the validity of plans. Frank C. et al. made forecast for the sale of women cloths using time series method and artificial neural networks and compared the obtained results. They collected data for four years and investigated the daily, weekly and seasonal changes. Exponential smoothing method and Winter's method were used in the study. They claimed that Winter's method yielded more accurate results than Artificial Neural Network method (6).

In the present study, demand forecasting was implemented in a chosen textile dyeing-finishing mill. Samples were chosen to represent 70% or more of total fabric production. Time series analysis and statistical methods based on demand forecasting were used in demand forecasting. Upon the completion of analysis, the most suitable method was determined for demand forecasting of each product group. STATISTICA packet software was used for data processing and application of models.

2. MATERIAL AND METHOD

2.1. Material

In the study, a big-sized dyeing-finishing mill in Çukurova Region was chosen and the study materials were determined for this mill. Workflow of production in textile mills occurs along the line organized according to product. For this reason, product type is an important parameter for collecting data in production planning and control. In demand forecasting, *"Demand forecasting of product group"* approach was employed to obtain data that could be used in PPC studies, as well. Product groups with intensified demand in a chosen Turkish Textile dyeing-finishing mill were determined and sampling was performed for the product groups. The selected dyeing-finishing mill mainly uses fiber and roll dyed fabrics. Therefore, 10 different samples were collected from products constantly produced and receiving the highest orders (approx. 70%). The other products (30%) consisted of special short-length orders. Demand for these products is too varied to be forecasted, and thus they were not included in the study. For one month period, a total of 1575000 m of demand was determined for these fabrics. More than half of the demand (60%) was made for fiber dyed, while the rest (40%) was made for roll dyed fabrics. In other words, 945000 m of demand was made for fiber dyed fabrics, and 630000 m of demand was made for straight dyed fabrics. The mean production capacities of the chosen mill were 15.000 m/day for fiber dyed products, and 10000 m/day for roll dyed fabrics. When the number of monthly working days is accepted as 25, monthly capacities are found as 25 day/1 month * 25000 m/day = 1250000 m/ month. Thus, when the capacity is organized by 60% fiber and 40% of roll dyed fabrics, dyed fabric production capacity is found 750000 m / month for fiber dyed and 500000 m /month for roll dyed fabrics. In textile, a common product name is determined for the demands of fabrics with the same properties. In the study, it was tried to select product groups with different compositions. Sample composition signifies the materials in fabric and their mixing rates. Important technical properties of each sample and composition analyzed in product phase are given in Table 1 and 2.

Table 3 shows the monthly demand amounts of fabric between 2004 and 2008. This table contains only the data of Sample-1 as an example, and similar data collection process was repeated for the other 9 samples. These data used in the analysis phase are the real and current values of a big-sized textile dyeing-finishing mill. These data corresponding to 60-month, namely 5 year-period, were evaluated by the selected demand forecasting methods. The total amount of 12-month demand values of the sample are given in the Table for information purpose only, and not used in the analyses.

Table 1. Selected samples and compositions

Sampl e type	Sample code	Sample composition PES (%)	VIS (%)	CO (%)	Elastane (Lycra) (%)	Weft density (unit -yarn/cm)	Warp density (unit-yarn/cm)	Weft type	Weight in m^2 (g/m^2)
Fiber dyed	S 1*	49	47		4	27	30	1/1 plain weave	220
	S 2	47,5	47,5		5	32	36	2/2 Z dimity	270
	S3	63	33		4	26	38	2/1 Z dimity	300
	S4	62	33		5	36	40	Fantasy	430
	S5	62	33		5	26	29	2/2 Z dimity	340
Roll dyed	S6	52		43	5	24	30	2/1 Z dimity	337
	S7			98	2	23	26,4	1/1 plain weave	190
	S8			98	2	23	46,7	4/1satin	175
	N9			98	2	34	55,8	4/1 satin	235
	S10			95	5	34	72	3/1 S dimity	195

*S1:sample 1

Table 2. Product Composition of Selected Samples

Yarn type			Yarn Num. (Ne)	Blend (%)	Direction of twist	Twist (tour/m)	Elastane (Lycra)
S1	Weft	1	44/2	PE/VIS % 50/50	S	735	44 dtex
		2	44/2	PE/VIS %50/50	S	735	44 dtex
		3	60/2	Polyester % 100	S	840	-
	Warp	1	44/2	PE/VIS %50/50	S	735	44 dtex
		2	44/2	PE/VIS %50/50	S	735	44 dtex
		3	60/2	Polyester % 100	S	840	-
S2	Weft	1	44/2	PE/VIS % 50/50	S	735	44 dtex
		2	44/2	PE/VIS %50/50	S	735	44 dtex
	Warp	1	44/2	PE/VIS %50/50	S	735	44 dtex
		1	44/2	PE/VIS % 50/50	S	735	44 dtex
S3	Weft	1	36/2	PE/VIS % 67/33	S	700	44 dtex
	Warp	1	36/2	PE/VIS % 67/33	S	700	44 dtex
S4	Weft	1	28/2	PE/VIS % 67/33	S	570	78 dtex
	Warp	1	28/2	PE/VIS % 67/33	S	570	78 dtex
S5	Weft	1	28/2	PE/VIS % 67/33	S	570	78 dtex
	Warp	1	28/2	PE/VIS % 67/33	S	570	78 dtex
S6	Weft	1	14/1	Carded %100	Z	600	78 dtex
	Warp	1	28/2	VIS % 100	S	570	78 dtex
S7	Weft	1	14/1	Linen %100	Z	600	-
	Warp	1	40/2	PE/VIS % 50/50	S	800	-
S8	Weft	1	30/1	Combed cotton %100	Z	800	-
	Warp	1	40/1	Combed cotton %100	Z	800	-
S9	Weft	1	14/1	Carded %100	Z	600	78 dtex
	Warp	1	30/1combed cotton	Combed Cotton %100	Z	800	-
S10	Weft	1	30/1	Carded %100	Z	600	78 dtex
	Warp	1	40/1 combed cotton	Combed cotton %100	Z	800	-

Table 3. Monthly Fabric Demands for Sample 1-5 between 2004 and 2008 (x1000 m)

Sample No	Months	Years 2004	2005	2006	2007	2008
Sample1	January	80	72	75	85	80
	February	80	75	74	75	100
	March	90	75	76	75	102
	April	90	82	81	58	94
	May	85	85	82	100	87
	June	87	100	89	100	89
	July	75	95	87	55	90
	August	78	100	109	75	90
	September	100	110	101	90	106
	October	110	120	106	90	120
	November	95	95	107	65	105
	December	85	90	103	80	80
	Total	**1055**	**1099**	**1090**	**948**	**1143**

2.2. Method

Textile sector is greatly influenced by economic crisis and developments in product group like fashion etc. Therefore, short-term forecasting is inconvenient, and long-term demand forecasting would be useful when accompanied by a good product survey. The most suitable time-based forecasting approach for dyeing finishing mills was determined as "short-term demand forecasting". Validity of the demand surveys is mainly depended on the accuracy of data rather than the prediction method.

Time Series Models, aiming to make forecast based on the past values of the variable, were used in the statistical analysis of the study. The initial point to develop a prediction model consists of defining the structure and components of the series. In this definition stage, it would be useful to make seasonal and auto-correlation investigations of the time graphic of series (11). Furthermore, determining the conformity of series to normal distribution pattern is also important for the assumption of the forecasting models to be developed (12). Basic Exponential Smoothing Method, Trend Smoothing Exponential Method and Winter's Models were used for demand forecast. Histograms were formed to conclude the most accurate forecasting model. Thus, distribution pattern of demands was determined. Basic Exponential Smoothing Method is calculated by taking the exponential weighted mean. In this method, recent coefficients are more important and principally taken into account for calculation. In Trend Corrected Exponential Smoothing Method, demand is calculated based on trend, while seasonal changes and trend are taken into consideration in Winter's Method. These three models were investigated on 10 samples and analyzed for the correct forecasting model. Conformity to normal distribution, histograms and auto-correlation graphics analyzing the distribution of errors were used for the analysis of data. It was aimed to have no difference between real sale values and errors, namely the overlapping of these values. The accuracy of the results was proved by statistical analysis. In addition, normal probability distributions and histogram graphics were used to visualize data. Performance analysis was employed to obtain correct results with the methods. And, it was demonstrated with auto-correlation graphics that the selected method remained under control limits, and the accuracy of the method was proved. STATISTICA packet software was used for the application of these methods. It was considered that the obtained results will facilitate the decision-making mechanism in production management in Dyeing-Finishing mills.

3. RESULTS AND DISCUSSION

3.1. Demand Analysis

In this section, Sample-1 is examined in detail to demonstrate how the chosen methods are applied and interpreted. Figure 2 shows the monthly changes in fabric demand between 2004 and 2008 for Sample 1.

The analysis of the past data is assessed to make demand forecasting. Horizontal axis in all graphics prepared by time series approach indicates months between 2004 and 2008 and the amounts of demand in these months. A linear increase is noted in the graphics. Thus, the presence of a linear trend could be mentioned. In addition, the effects of seasonal changes can be remarked when model is analyzed by one-year periods. Demand increase is effective in six-month periods, while sudden decrease in demand in the subsequent six-month periods is effective on this decision. In this regard, it could be claimed that a model combining trend and seasonal effect would be more suitable. The results of Basic Exponential Smoothing Method for Sample 1 are given in Figures 3, 4, 5 and 6, while the results of Trend Corrected Exponential Smoothing Method are given in Figures 7, 8, 9 and 10, and finally, the results of Winter's Model are given in Figures 11-14.

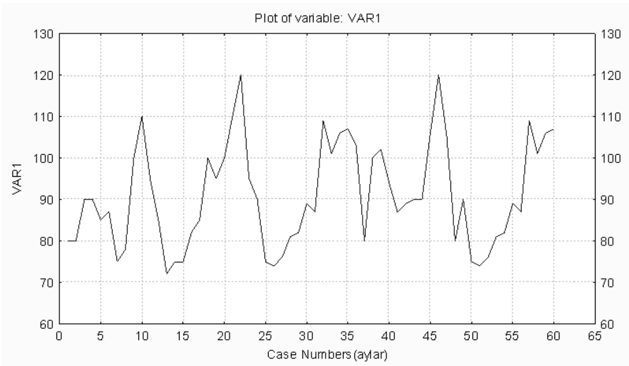

Figure 2. Monthly changes in fabric demand between 2004 and 2008 for Sample 1

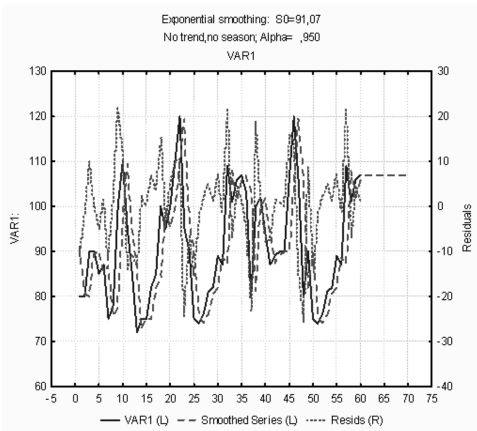

Figure 3. Forecasts and Forecast Errors by Basic Exponential Smoothing Method

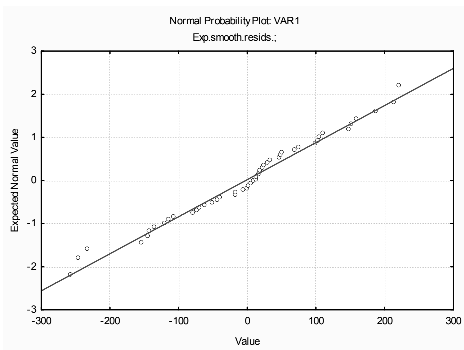

Figure 4. Normal Probability Graphic of Forecast Errors by Basic Exponential Smoothing Method

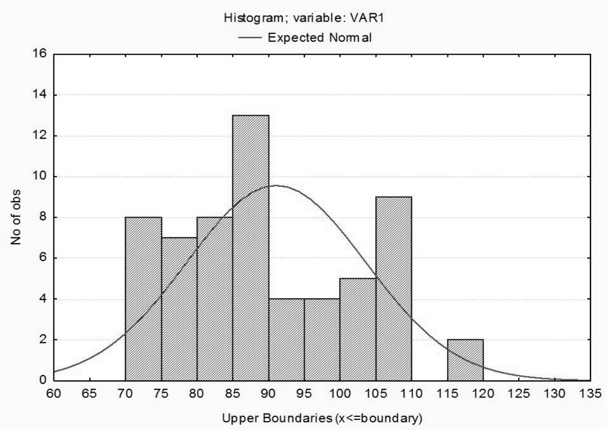

Figure 5. Histogram of Forecast Errors by Basic Exponential Smoothing Method

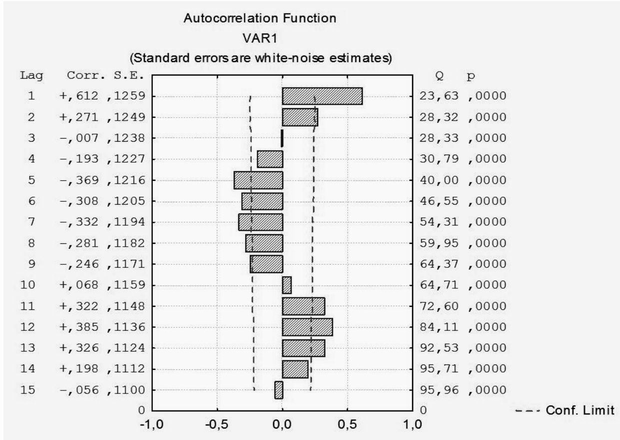

Figure 6. Auto-correlation Graphic of Forecast Errors by Basic Exponential Smoothing Method

Values are arranged around 0 and demonstrate some deviations. Here, a formation close to stereotype is observed. Normal probability graphic of forecasting errors is shown in Figure 8. It could be suggested that forecasting errors in the normal probability graphics are better compared to those in Basic Exponential Smoothing method. Similarly, there are deviations especially in the first and last years. Errors range around ± 100. Histogram of forecasting errors (Figure 9) somewhat agrees with normal standard distribution. Blocks deviating from the line indicate the surplus of demand. Furthermore, demand could not be met in some points. There are considerable increases in errors especially occurring in 0-50 area. Auto-correlation graphic is given in Figure 10. Accordingly, the number of data out of control limits is quite high. There are deviations both in negative and positive directions. However, this could be disregarded as it gives the relations between errors. Sinusoidal formation exhibits its effects similar to auto-correlation in Basic Exponential Smoothing Method. This situation could occur because seasonal changes were not included in the model. It was concluded that Trend Corrected Exponential Smoothing Method would yield more accurate forecasts for Sample 1 compared to Basic Exponential Smoothing Method.

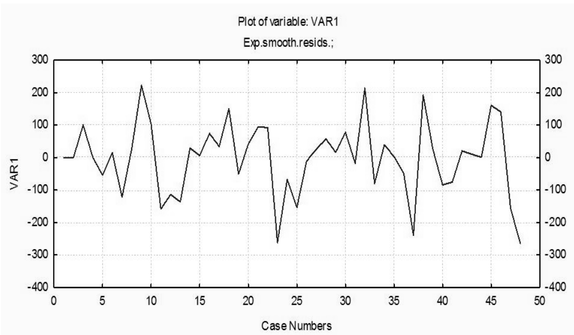

Figure 7. Time-dependent Graphic of Forecast Errors by Trend Corrected Exponential Smoothing Method

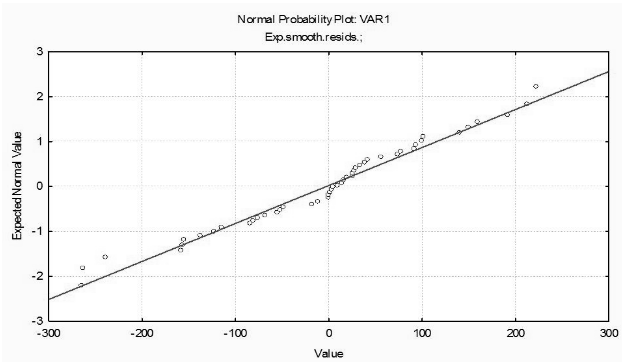

Figure 7. Normal Probability Graphic of Forecast Errors by Trend Corrected Exponential Smoothing Method

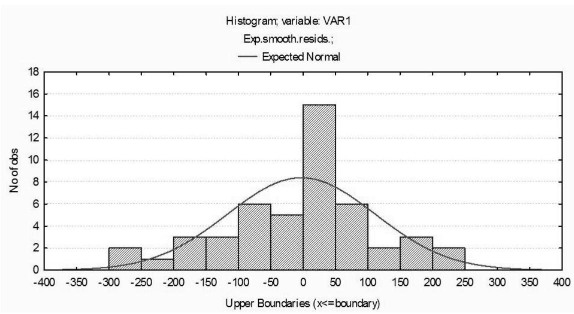

Figure 9. Histogram of Forecast Errors by Trend Corrected Exponential Smoothing Method

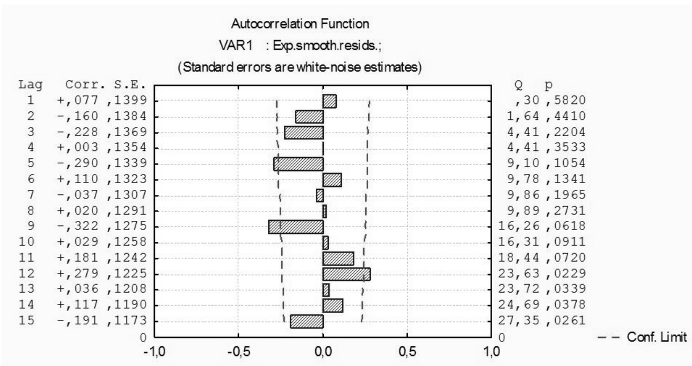

Figure 10. Auto-correlation of Forecast Errors by Trend Corrected Exponential Smoothing Method

3.2. Basic Exponential Smoothing Model

The Results of Basic Exponential Smoothing Method for Sample 1 are given in Figure 3, 4, 5 and 6. In graphics, VAR (Variable) indicates real sale values, Smoothed signifies series forecasts, and Resids indicates error terms. Sale values and forecasted values do not exactly overlap with each other in the graphics. This indicates that model followed the reactions one step behind. Absence of overlap is not so big, but it is still not at an acceptable level. In addition, error values occurred quite different than standards. These data indicate the inadequacy of this model. The reason could be attributed to the fact that seasonal fluctuations were not taken into account in the model. The examination of histogram of forecasting errors revealed that there was a considerable deviation from normal probability values, which did not comply with normal distribution (Figure 5). Some forecasts are higher than the required values, but some others are too low to meet the demand. In addition, they are inadequate because seasonal fluctuations are disregarded. Therefore, this indicates once more that the forecasting model is inadequate. The auto-correlation results of forecast errors are given in Figure 6. Auto-correlation graphic analyzes the relations between errors. In this graphic, values on dashed-line are control limits, and the values should not exceed these limits. However, there are many overflows in this figure, which are observed both in negative and positive directions. Because the forecasts for Sample 1 exceeded the control limits, Basic Exponential Smoothing Model was concluded to be not adequate for demand forecasting.

3.3. Trend Corrected Exponential Smoothing Method

Trend Corrected Exponential Smoothing Method was used to investigate the trend-based changes in demand. When the time-dependent graphic of forecasting errors is examined for Sample 1, this method provides better distribution than Basic Exponential Method, and its limit values are lower, as well.

3.4. Winter's Model

In this section, Winter's Model is discussed using data of Sample 1. In Figure 11, time-dependent graphic of forecast errors could be accepted within a certain band width. However, there is a random distribution not corresponding to a certain pattern. In Figure 12, probability values of forecast errors shows deviations in the initial years, but they stay within the acceptable level. This is a valid example for the accuracy of the model. Errors are randomly distributed below and over zero value without any rule and with a slowly increasing variance. However, this alone does not make a sense as this is the error graphic. Error rates reached -300 and + 300 limits. This error trend was caused by sudden increases in trend after decreases near these limits, which could result from sudden decreases in demand or seasonal effects. The period of sudden increases and decreases changed between 3-5 months. This favors the idea that seasonal changes are effective on demand. Winter's Model is based on the assumption that fluctuations increase on year basis. Histogram of forecast errors is shown in Figure 13, and it partially corresponds to normal standard distribution. Similar to Trend Smoothing Exponential Method, there are surplus in demand in some points, and demand could not be met in some other points. Auto-correlation graphic is given in Figure 14. Values were found under control limits in general. In the control limit number 11, an overflow beyond control was observed in positive direction. No sinusoidal shape was detected. This proves the accuracy of the model, once again.

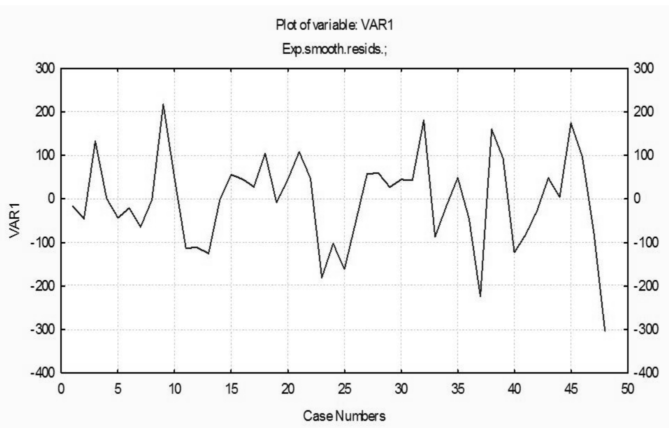

Figure 11. Time-dependent Graphic of Forecast Errors by Winter's Complete Model

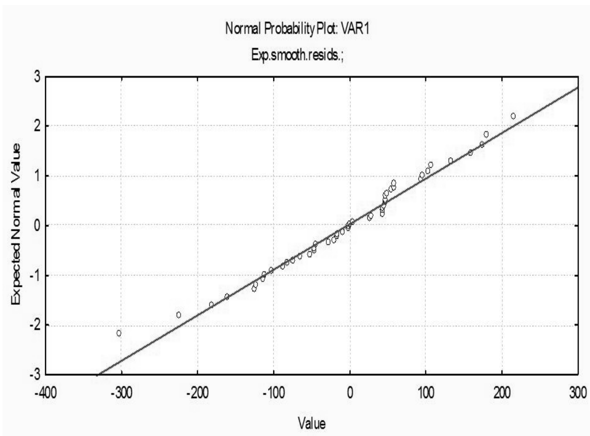

Figure 12. Normal Probability Graphic of Forecast Errors by Winter's Complete Model

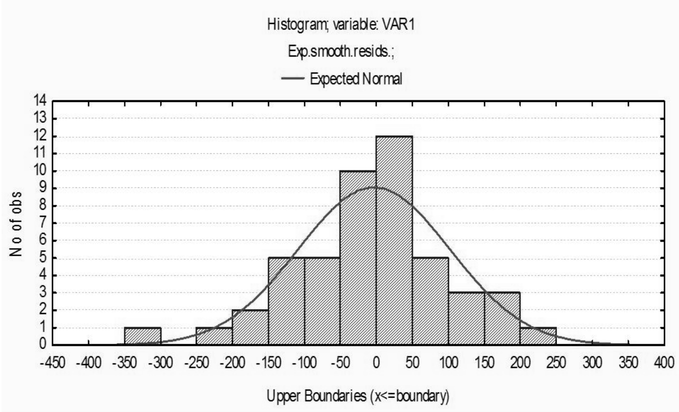

Figure 13. Histogram Forecast Errors by Winter's Complete Model

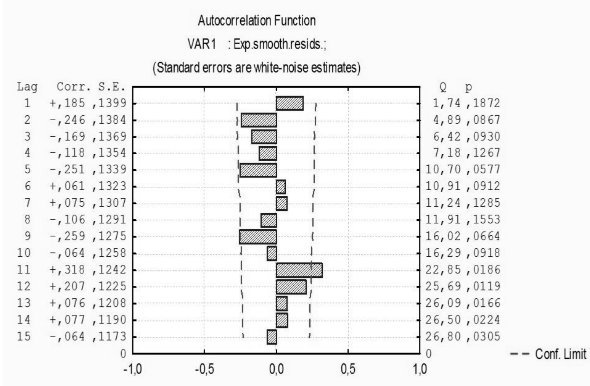

Figure 14. Auto-Correlation Graphic Forecast Errors by Winter's Complete Model

In the study, demand analysis for Sample 1 was also repeated for the other 9 samples and the suitable forecasting model was given for each sample in Table 4. Demand sizes of all samples were found compatible with Poisson distribution. Among all the methods, Winter's Model was concluded as the most suitable method for demand forecasting as it considers dominant trend and seasonal effects.

It is seen in the table that the distribution of fiber and roll dyed orders does not correspond to Basic Exponential Smoothing Method. Fiber dyed production changes with trend and seasonal effects, and roll dyed production changes with seasonal effects. Fiber dyed fabric composition mainly consists of polyester and viscose, which could be obtained in all seasons. Therefore, it was found significant that the changes in demand were dependent on both trend and seasonal variations. The Simultaneous examination of Table 1 and 2 indicates that the main difference of sample 4 and 5 from other fiber dyed fabric samples is their heavier weight in m^2 (heavy fabric). The demand for these fabrics is dependent on trend, which indicates the accuracy of the forecast. Sample 6 is a different fabric among roll dyed fabrics in terms of both composition and weight in m^2. Similar to sample 4 and 5, weight in m^2 of this fabric is heavier than those of other fabrics, which implies that it passes through a trend-dependent demand period. In the production of other roll dyed fabrics (sample 7-10) except for sample 6, cotton is the dominant raw material. Production stage of cotton exhibits variations based on seasonal effects, as well.

Table 4. Suitable Forecasting Methods for Samples

Sample Type	Sample code	Basic Exponential Smoothing Method	Trend Corrected Exponential Smoothing Method	Winter's Method
Fiber Dyed	S1			√
	S2			√
	S3			√
	S4		√	
	S5		√	
Roll Dyed	S6		√	
	S7			√
	S8			√
	S9			√
	S10			√

√: signifies the suitable forecasting methods selected for samples.

4. CONCLUSION

Demand for textile sector has a strategic importance and is influenced by economic developments and market changes very quickly. Textile mills using of time-series models for forecasting of demand will be able to be more successful and realistic production planning. As a result of this study, the in the general overview, Time series models could be used for effective demand forecasting in textile dyeing-finishing mills. The demand was concluded to change based on both seasonal and trend effects in textile dyeing-finishing mills. Winter's Method was found as the most effective method in demand forecasting for the demands of Fiber Dyed fabrics and Roll Dyed fabrics. Demand forecast could be performed by this model in Production Planning and Control studies. Monthly demand data in the year must be recorded Textile Dyeing Finishing mills.

Error by comparing the differences between the predicted values and actual values should be examined. In cases where large differences in the accuracy of the data should be reviewed. Time series forecasting methods used at the end of the year in the next year / season, the demand forecasting can be done. Demand forecast for the next year/season could be made by saving data in Textile Dyeing-Finishing Mills and using demand forecasting methods at the end of each year. Cost reduction efforts could be made using the knowledge that the cost of roll dyed fabrics is high under variable demand. Highly accurate demand forecasting studies could be performed by applying the present study to other main processes in textile industry. These techniques used in demand forecasting will help develop strategies and resource planning in mills.

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