ASSESSING EXPORT PERFORMANCE OF TEXTILE COMPANIES IN ESKISEHIR ORGANIZED INDUSTRIAL ZONE BY USE OF DATA ENVELOPMENT ANALYSIS (DEA)

ESKİŞEHİR ORGANİZE SANAYİ BÖLGESİNDEKİ TEKSTİL FİRMALARININ İHRACATLARINDAKİ ETKİNLİKLERİNİN VERİ ZARFLAMA ANALİZİ (VZA) İLE DEĞERLENDİRİLMESİ

Füsun YENİLMEZ[*], Nuray GİRGİNER

Eskişehir Osmangazi University, Faculty of Economics and Administrative Sciences, Department of Economics, Eskişehir, Turkey

ABSTRACT

The aim of this study is to examine the efficiencies of textile firms' exports in Eskisehir Organized Industrial Zone during the period 2008-2009 by using Data Envelopment Analysis (DEA). The study analyzes 5 firms as a decision making units by applying two DEA models (3 inputs-1 output CCR (Charnes, Cooper and Rhoders) models). The results show that Sarar Textile is efficient based on the two DEA models, while Buzlu Clothing, introducing export operations in 2008, is the most efficient in 2009. The study also finds that inefficient companies should decrease their production quantities whereas they have to increase the amounts of the export values.

Key Words: Textile sector, Export, Efficiency, Data envelopment analysis (DEA), Eskisehir Industrial Zone

ÖZET

Bu çalışmanın amacı, 2008-2009 yıllarında, Eskişehir Organize Sanayi Bölgesinde faaliyette bulunan tekstil firmalarının ihracatlarındaki etkinliklerinin Veri Zarflama Analizi (VZA) ile incelemektir. Her iki yıl için 5 firmanın karar verme birimi olarak alındığı 3 girdi(net aktifler, işçi sayısı, üretim miktarı) ve 1 çıktıdan (ihracat) oluşan çıktıya yönelik CCR (Charnes,Cooper and Rhoders) modelleri kurulmuştur. Analiz sonucunda Sarar Giyim her iki yılda da etkin firma olarak bulunmuştur. İhracata 2008 yılında başlayan Buzlu Konfeksiyon ise 2008 yılında etkin değilken 2009 yılında etkinliğe ulaşmıştır. Analiz sonucunda elde edilen bir diğer bulgu, etkin olmayan firmaların etkinliğe erişmelerinde üretim miktarlarında azalmaya veya ihracatlarında artışa gitmeleri gerektiğidir.

Anahtar Kelimeler: Tekstil sektörü, İhracat, Etkinlik, Veri zarflama analizi (VZA), Eskişehir Organize Sanayi Bölgesi

[*] **Corresponding Author:** Füsun Yenilmez, yenilmez@ogu.edu.tr, Tel: +90 222 2393750/1152 Fax:+90 222 229 25 30

1. INTRODUCTION

Textile and apparel industries are considered as key sectors during the process of economic development for the countries that adopt export-led growth strategy because of value-added created in the production process and contribution to the national economies in terms of export and employment. The world exports of textile and apparel have amounted to $238.1 billion and $345.3 billion respectively in 2008; the share of textile export within the world exports was 1.7% whereas this was 2.5% for apparel (1). The leading countries in the world textile exports are EU countries, China, the US, India, Turkey and Pakistan (2).

Export-led development/growth views exports as the engine of the national economy. Turkey which adopted an outward-oriented economic approach starting in 1980s is among the countries that has taken visible steps in this regard (3). Turkey ranks 2nd in the textile and clothing exports to the EU countries, 7th in the cotton production, 4th in the cotton consumption, 5th in the staple ring spinning production, 4th in the open end spinning production and 1st in the organic cotton production (4).

Turkey which used to export textile products including yarn, fiber and fabric in the early 1980s moved its export operations to apparel starting in the early 1990s. In 1995, textile industry was received substantial investment because of the expectation that foreign trade with the EU countries will boost after the entry into force of the customs union agreement between Turkey and the EU that eliminated all custom duties and charges having equivalent effect in 1996. However, the amount of investments has gradually diminished over the years. Investments experienced a sharp decline in 1998 due to an economic crisis after which a state of overall deterioration has been observed in the economic indicators and the exports (5).

Subsequent to the accession of China, one of the Turkey's main competitors in textile industry, to the World Trade

Organization (WTO) in 2001 and the abolition of the textile and apparel quotas in 2005 in accordance with the provisions of the WTO-Agreement on Textiles and Clothing, Turkey experienced a state of stagnation in the export of textile products. For this reason, the annual growth rate of over 20% in 2003 and 2004 declined to 9.7% during the period between 2005 and 2008. The amount of exports in textile industry significantly declined (18%) in 2009 due to the global economic crisis. However, decrease in exports of the sector industry still remained below the overall decline in the exports of national economy (22.6%) in the same year (6).

Researchers show continued interested in the textile industry because of its appeal to the exporters in many countries of the world. Detailed analyses are made to shed light on the overall state of the industry while relatively restrictive studies focus on the regional and provincial aspects of the sector. Literature is full of studies depicting the overall situation of the textile industry in a given country (7, 8, 9). Studies on Turkish Textile and Apparel Sector in areas as diverse as export (10,11,15), economic impact (13,14), financial (17), competitive situation (12) and production (16, 18) show paralelism with studies in other countries.

In the Eskisehir Organized Industrial Zone, the textile firms operating in the domestic market also open up to the foreign markets by introducing Turkish brands. This study is justified by the fact that there is no single research on the assessment of the performances of the textile firms in Eskisehir. The study seeks to offer some key suggestions for further improvement of the performances of the firms based in Eskisehir Organized Industrial Zone. 5 exporting firms in the zone are included in the analysis which relies on a model of two separate data envelopment analyses for the years 2008 and 2009 towards output maximization.

2. METHOD

The study carries out the measurements of the technical efficiencies of the textile firms in Eskisehir Organized Industrial Zone in terms of their exports for the period between 2008 and 2009 by use of data envelopment analysis (DEA). Two DEA models created for the years 2008 and 2009 are 3-inputs and 1-output CCR models for the output maximization. Frontier Analyst software is employed in the implementation of the DEA technique. The input and output data of the firms are retrieved from the Directorate of Eskisehir Organized Industrial Zone, and the annual reports of the firms.

The mathematical structure of the DEA model was first introduced as a fractional programming model by Charnes, Cooper and Rhoders (19). DEA is a widely practiced method used for performance benchmarking and comparison, and the first application of DEA technique was performed over the public sector service enterprises. It is currently a method applicable in many fields. DEA is a technique based on linear programming that seeks to measure the relative performance of the decision units in cases where inputs and outputs measured by multiple scales pose challenges in the execution of the comparison (20). It is necessary for the decision units to be analyzed to have similar functions focusing on the same objective and to operate under the same market circumstances. It is also imperative for all units in the group to be identical in terms of the factors identifying their efficiencies, excluding unit size and intensity. In addition, all inputs and outputs should be represented by positive numbers; and there should be no null input or output (21). DEA compares the production units, considered to be identical, to identify the best observation as efficiency frontier. Other observations are assessed by reference to this frontier. The inefficiency level and its roots and causes in every decision unit are identifiable by use of the DEA. This provides insights for the executives and top administrators on how to decide with respect to the increase in the amount of inputs and/or decrease in the amount of outputs (22).

DEA models are analyzed in two separate groups: input-oriented and output-oriented. Because output-oriented DEA model is employed in the present study, a general formulation on this sort of DEA model is provided below:

Objective function:

$$Enb \ h_k = \sum_{r=1}^{s} u_{rk} y_{rk} \qquad ; k=1,2,3,\ldots,n$$

Restrictive conditions:

$$\sum_{r=1}^{s} u_{rk} y_{rj} - \sum_{i=1}^{m} v_{ik} x_{ij} \leq 0 \quad ; j=1,2,3,\ldots,n$$

$$\sum_{i=1}^{m} v_{ik} x_{ik} = 1$$

$u_{rk} \geq 0$; \qquad r = 1,2,3,\ldots,s
$v_{ik} \geq 0$; \qquad i = 1,2,3,\ldots,m

m   : number of inputs,
s   : number of outputs,
n   : number of decision units,
x_{ij} : amount of i. input used by the jth decision making unit
y_{rj} : amount of r. output produced by the jth decision making unit
u_{rk}, v_{ik} : The weights that were given by decision making unit for i. inputs and r outputs
The DEA performs the following stages in the measurement of relative efficiency (23):

i. Identification of the best observations (or the decision making units on the efficiency frontier) generating the largest composition of output by use of the least combination of input within a given observation group

ii. Radial measurement of the distance of the inefficient decision making units to the identified frontier, considered as reference point

3. RESULTS AND DISCUSSION

The Eskisehir Organized Industrial Zone has been known for its huge contribution to Turkish national economy. The zone hosts currently active 8 textile companies while there are also 27 registered firms under the heading of weaving, clothing and leather manufacturing industry. However, 5 out of these 8 are included in the analysis. The remaining 3 companies were not included in the research analysis because of the following reasons: The Anadolu Textile Furniture Sponge and Package Industry Trade Corporation is left out since it is supplier of fiber in domestic market and does not make any export. CCS Clothing Industry and Trade Corporation, one of the companies with the largest production capacity, makes its productions as an affiliate of Sarar Clothing Textile Industry and Trade Corporation. Therefore, as an affiliate company of Sarar Clothing, the CCS Clothing does not manufacture for other companies nor does it make any exports. One other company not included in the analysis is Güven Karaca Leather Industry and Trade Limited Company. The firm manufactures and exports leather and leather products including belt, purse and bracelets. Because all other actors referred to in this study are focused on producing and exporting textile and apparel products, Güven Karaca Leather was left out of the analysis considering that failing to do so might have been misleading.

In the DEA applications, special attention should be paid to make sure that decision making units is not smaller than the one required under the linear programming model to be employed in the study. In case the number of selected inputs is referred to as m and the number of outputs as s, the least number of decision making units should be m+s+1 for the credibility of the research (24). This restriction has been taken into account for the period between 2008 and 2009 in the study which analyzes five textile companies (Cetintas Textile, Sarar Clothing, Buzlu Clothing, Kanat Textile, Cetintas Clothing). The reason the period of analysis was picked as the era between 2008 and 2009 is that Buzlu Clothing, one of the firms taken as decision making unit, started its export activities in 2008; therefore, in case it was excluded, the condition that the DEA should be m+s+1 would not have been met. In addition, in order to better analyze the improvement of the firms, their performance in exports over two years was evaluated.

The export efficiency of the firms will be analyzed in this study. The net assets of the firms (TL), the number of workers and production quantities are taken as input factors, and the export values ($) as output in the research. Therefore, such a preference meets the requirement referred to above stating that the number of decision making units should be at least input numbers + output numbers+1.

The results and findings based on the 3-input and 1-output DEA models during the period between 2008 and 2009 for 5 textile firms in Eskisehir are given in Table 1. The analysis finds that Sarar Clothing and Kanat Textile are the efficient companies in 2008 whereas the efficient firms of the year 2009 are Buzlu Clothing and Sarar Clothing in terms of export performance. Kanat Textile, efficient in 2008, ranks in the bottom in the standing of the efficiency for the year 2009.

One of the advantages of the DEA method is its ability to maintain achievable goals for the inefficient decision units to improve their performance. It is assumed that the inefficient decision units attain the level of effectiveness of the relatively efficient units by reliance on their methods and practices (25). An answer to the question as to what extent and in what amounts the inefficient decision making units employ their inputs and outputs is given by assessment of the best combinations of the decision making units in the best observation group based on the comparison between the efficient decision making units. The value of effectiveness of all units in the reference group of each inefficient decision making unit is equal to 1 (26). The potential improvement values assessed for each of the three firms identified as inefficient based on the findings in the study for the years 2008 and 2009 are presented in Table 2 and 3.

Buzlu Clothing, one of the inefficient firms in terms of exports in 2008, will become an efficient firm in its exports like its reference firm, Kanat Textile, in case it reduces its number of workers by 82.56% and production quantities by 57.5%, or increases its export values by 164.4%. Buzlu Clothing has become efficient in terms of export performance in 2009 after these improvements (Table 3). Likewise, Cetintas Clothing, one of the inefficient firms in 2008, would become efficient like Sarar and Kanat Textile, both reference firms, in case it reduces its number of workers by 61.69%, or increases its export values by 13.13% without changing its net assets and production quantities. Cetintas Textile, another inefficient firm in 2008, would become efficient like its reference firms, Kanat Textile and Sarar Clothing, in case it reduces its production quantities by 18.33% and increases its export values by 30.48% without changing its net assets and the number of workers.

Table 1. The efficiency of textile firms in Eskisehir for the period 2008-2009

Textile Firms	Efficiency and ranking by years				Average efficiency of textile firms (2008-2009)
	2008	Ranking	2009	Ranking	(2008-2009) Average and ranking
Buzlu Clothing Industry and Trade Corporation Limited Company	38,82	4	100,00	1	69,41 (5)
Çetintaş Clothing Industry and Trade Corporation	88,39	2	92,40	2	90,395 (2)
Kanat Textile Transportation Marketing Industry and Trade Limited Company.	100,00	1	64,56	4	82,29 (3)
Sarar Clothing Textile Industry and Trade Corporation	100,00	1	100,00	1	100,00 (1)
Çetintaş Textile Industry and Trade Corporation	76,64	3	78,34	3	77,49 (4)

Table 2. Potential improvement rates, reference frequencies and reference groups of textile firms for the year 2008

Textile firms	Factors		Potential improvement (%)	Reference frequencies	Reference groups
BUZLU CLOTHING	Inputs	Net assets	0	0	Kanat Textile
		Number of workers	-82,56		
		Production quantities	-57,50		
	Output	Exports	164,40		
ÇETİNTAS CLOTHING	Inputs	Net assets	00,00	0	Kanat Textile Sarar Clothing
		Number of workers	-61,69		
		Production quantities	00,00		
	Output	Exports	13,13		
KANAT TEXTİLE	Inputs	Net assets	00,00	3	Efficient
		Number of workers	00,00		
		Production quantities	00,00		
	Output	Exports	00,00		
SARAR CLOTHING	Inputs	Net assets	00,00	2	Efficient
		Number of workers	00,00		
		Production quantities	00,00		
	Output	Exports	00,00		
ÇETİNTAS TEXTİLE	Inputs	Net assets	00,00	0	Kanat Textile, Sarar Clothing
		Number of workers	00,00		
		Production quantities	-18,33		
	Output	Exports	30,48		

Table 3: Potential improvement rates, reference frequencies and reference groups of textile firms for the year 2009

Textile firms	Factors		Potential improvement (%)	Reference frequencies	Reference groups
BUZLU CLOTHING	Inputs	Net assets	00,00	3	Efficient
		Number of workers	00,00		
		Production quantities	00,00		
	Output	Exports	00,00		
ÇETİNTAS CLOTHING	Inputs	Net assets	00,00	0	Buzlu Clothing, Sarar Clothing
		Number of workers	-55,53		
		Production quantities	00,00		
	Output	Exports	08,22		
KANAT TEXTİLE	Inputs	Net assets	00,00	0	Buzlu Clothing, Sarar Clothing
		Number of workers	00,00		
		Production quantities	-62,02		
	Output	Exports	54,88		
SARAR CLOTHING	Inputs	Net assets	00,00	3	Efficient
		Number of workers	00,00		
		Production quantities	00,00		
	Output	Exports	00,00		
ÇETİNTAS TEXTİLE	Inputs	Net assets	00,00	0	Buzlu Clothing, Sarar Clothing
		Number of workers	00,00		
		Production quantities	-32,08		
	Output	Exports	27,64		

A review of Table 3 reveals that Sarar Clothing and Buzlu Clothing are efficient firms. Cetintas Clothing, one of the inefficient firms, would become efficient like its reference firms, Buzlu Clothing and Sarar Clothing, in case it reduces its number of workers by 55.53%, or increases its export values by 8.22% without changing its net assets and production quantities. The fact that Cetintas Clothing's lower improvement rate in 2009 compared to the figures from the last year indicates that this firm comes closer to effectiveness (the efficiency ratio rises from 88.39% in 2008 to 92.40% in 2009). However, it needs to focus on further improvement even though this could be lower levels at the same input and output variables. Kanat Textile is an inefficient firm in 2009. The primary reason for this could be that it declared financial loss in this year. However, Kanat Textile would become efficient like its reference firms in case it increases its production quantities by 62.02% and its export values by 54.88% without changing its net assets and number of workers. Likewise, Cetintas Textile, another inefficient firm, would become efficient by reducing its production quantities by 32.08%, or increasing its export values by 27.64% without changing its net assets and number of workers.

Table 2 and Table 3 show that Sarar Clothing and Kanat Textile are reference units in 2008 for the inefficient units whereas this role is to be assumed by Sarar Clothing and Buzlu Clothing for the year 2009. The reference units and the inefficient units they serve as reference firms have identical structure of operation and activities. Therefore, any given inefficient unit may become efficient by performing activities compatible with the field of activity of the reference firm. The frequency of the service as reference firms for the other units by staying at the efficiency frontier shows that the structure of these firms is fairly strong. Kanat Textile serves as reference firm for 3 firms in 2008 when it appears to be a company that shows the best export performance with its existing inputs. Sarar Clothing, efficient in both 2008 and 2009, is considered a successful and strong firm able to channel its existing inputs toward export activities. Owing to its high quality workmanship and products, SARAR competes with global brands in clothing sector. Sarar Clothing is the only textile and apparel firm active in Eskisehir Organized Industrial Zone that is ranked within Turkey's top 500 largest industrial corporations.

The last column of Table 1 provides the efficiency rankings of the firms during the two-year period based on the average values of the efficiency measurements over the same period. The findings show that the analysis run based on the input and output variables for the period between 2008 and 2009 ranks Sarar Clothing in the 1st place as a company operating effectively in both 2008 and 2009. Sarar Clothing is followed by Cetintas Clothing and Kanat Textile in the ranking. Even though it ranks at the bottom in terms of export performance in both 2008 and 2009, it should be noted that Buzlu Clothing started its export operations in 2008. Furthermore, this firm has proven its success in exports over the next year shortly after it started export operations.

4. CONCLUSIONS

Textile industry, which has remained a leading sector in Turkey owing to its contributions to the general export figures, attracts a great deal of scholarly attention despite ongoing problems due to intense competition. Eskisehir region hosts firms which have a significant share of Turkey's textile exports. A small number of firms in the region attract attention by their visible contribution to the growth of the national export figures.

This study analyzes the efficiency of 5 exporting firms registered to the Eskisehir Chamber of Industry based on 3-input and 1-output models by use of DEA methodology. The success of Sarar Clothing, efficient in both 2008 and 2009, in terms of efficiency is compatible with the expectations. Sarar Clothing has become a leading brand of Turkey and the city of Eskisehir owing to its success. It is a national company known for its high quality production and worldwide reputation in textile industry. Owing to its high quality workmanship and products, SARAR competes with global brands. In 2010, it exports to 37 countries (the U.S., Germany, Austria, Belgium, United Arab Emirates, Bulgaria, Czech Republic, China, Denmark, France, South Africa, India, Holland, Hong Kong, Britain, Spain, Israel, Sweden, Switzerland, Italy, Japan, Canada, Qatar, Cyprus, Libya, Lebanon, Hungary, Mexico, Egypt, Russia, Slovakia, Tunisia, Turkmenistan, Ukraine, Jordan, Yemen and Greece). In the same year, the Uludag Exporters' Association (UIB) also presented the export achievement award to Sarar as a successful firm in textile and apparel industry.

The firms based in the city currently carry out their activities with visible success. Considering the firms that displayed inefficiency in both 2008 and 2009, it becomes evident that there is no problem with respect to the number of workers and inputs of net assets, whereas these firms experience problems with respect to the efficiency that can be fixed by reduction of the production quantities and increase of the export values. This could be caused by the failure to market the surplus production in external markets.

The findings based on the analysis show that these firms are facing serious marketing problems in both domestic and international markets. In this specific market with a high added value, it is extremely important to offer new designs that will appeal to the consumers, high quality products and introduce the brand. Textile firms based in Eskisehir converting quality into a brand and brand promotion in the international arena need to focus on brand-building efforts in order to contribute to the development of the textile sector. In addition, the issue with respect to the production quantities may be caused by the inability of the companies in the market to properly and swiftly respond to the market changes and trends. These firms can be recommended to make their product life spans more flexible. The emerging interactive and smart textile market will be attractive in the long term. In the future, people will show greater interest in services and products in such fields as health, security and IT, in addition to the dressing and veiling. In line with these views, the textile companies in Eskisehir and Turkey need to launch activities for research and development of these products.

In order to maximize the efficiency of the Eskisehir-based textile companies in exporting activities, they need to produce high quality standards compatible with international quality standards. In addition, focus on special designs, quality, productivity,

marketing and distribution will take the firms to an upper level where they would appeal to the higher-income groups; and this will eventually improve the export success. The textile firms in Eskisehir need to start additional activities in line with these recommendations on research and development of these products. Fashion designs and brands developed based on research and development activities should be supported by efforts of well-designed advertising and marketing works. The works to build appealing brands will play a significant role in the improvement of the local firms in textile industry in Eskisehir.

Another important point that needs to be underlined is the period where the analysis has been carried out. The paper studies the period between 2008 and 2009. These years are known as a period of global financial crisis when the United States as well as many European states has imposed restrictions over foreign trade. Coincidentally, the American and European markets are the leading destinations for Turkish textile products. Therefore, the state of excessive production and reduction in export in the Eskisehir-based companies and the textile firms in Turkey can be attributed to the natural outcome of the global crisis over this period.

The analyses may be rerun by use of different input variables in future studies; furthermore, the efficiency changes in the exports based on the same inputs may be compared to the future performances of the firms under review. Such works and studies will provide significant knowledge and information for regional firms and national industries and further help create relevant policies.

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