Journal of Agricultural Sciences (JAS) 32(2):363-374
DOI: 10.15832/ankutbd.1655190

J Agr Sci-Tarim Bili
e-ISSN: 2148-9297
jas.ankara.edu.tr

The Problems in Seafood Exports to the EU and Solutions Proposals

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ARTICLE INFO
Research Article
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Received: 10 March 2025 / Revised: 17 November 2025 / Accepted: 10 December 2025 / Online: 24 March 2026

Cite this article
Özçalkalp S, Şen, F, Oğuzhan A (2026). The Problems in Seafood Exports to the EU and Solutions Proposals. *Journal of Agricultural Sciences (Tarim Bilimleri Dergisi),* 32(2):363-374. DOI: 10.15832/ankutbd.1655190

ABSTRACT
With this study conducted to identify the problems affecting the productivity of exporting processing plants; export data, export problems of the processing plants having permission to seafood export to the European Union and published on the official website of The Ministry of Agriculture and Forestry in 2018, and the effects of export problems on their performances and suggestions to these problems were determined. The questionnaire could be applied to approximately 65% of the companies and empirical dimension of the subject was discussed. The obtained data was analyzed using statistical programs and interpreted.

In conclusion of the evaluations, it has been revealed that 49.3% of the processing plants are medium-sized, according to Data Envelopment Analysis results, 15 enterprises, corresponding to 20.5% of the total enterprises participating in our survey, operate 100% efficiently. It has been determined that the problems identified can be experienced by enterprises in all classes. Since our understanding of quality in export is to obtain products in accordance with the criteria of the countries we export to, enterprises produce in EU standards in accordance with the legislation. There is a foreign trade surplus in the seafood export sector which reduces the country's overall foreign trade deficit. It has been determined that companies have problems such as lack of raw materials, inability to find raw materials on time, price imbalance caused by competition affects production and costs are high. It has been identified that tax policies of import country limits exports, they have difficulties to find space especially in air cargo and others. The problems of the border control points stress exporters out, the existence of bureaucratic difficulties should be resolved. It has been foreseen that organization is essential, product diversity should be increased, authorities should be more active, sector-specific loans and incentives should be created.

Keywords: Data envelopment analysis, Export performance, Foreign trade surplus, Seafood export, Seafood export problems

1. Introduction

With the increase in the world population, there is also an increase in need for food to meet needs of all people (Coolgeography 2023). Fish and other seafoods include well balanced amino acid mixtures in addition to omega 3 fatty acids, Vitamin D, vitamin B12, Selenium, İodine, Choline, Taurine (Lund 2013).

The use of seafood in the food chain has increased over the years (Ayer et al. 2008). With the globalization of food production systems, aquaculture has been among the most traded products (Gephart & Pace 2015).

Türkiye which is the leader of Europe in trout, sea bream and sea bass production, is followed by Greece in sea bream and sea bass production and followed by Norway regardless of size in trout production (Feap 2020). According to data (TÜİK 2021) The value of seafood export of Türkiye to the world is more than the import value, sector has foreign trade surplus which reduces the country's overall foreign trade deficit. Seafood export of Türkiye to the EU Countries increased by approximately 30% between 2014-2019. Although there was a regular increase in both Türkiye's total seafood exports to the world and to the EU, it has been observed that there had been a decrease in the ratio of seafood exports to the EU in total seafood exports. Our seafood exports to Greece had increased approximately 10-fold from 2014 to 2019. The Food and Agriculture Organization of the United Nations (FAO) said that the rapid growth in Türkiye's fish exports to Greece reflects the difficulties for EU producers faced in competing with Türkiye even in their own domestic markets, and that in fact the oversupply of products to the market is driving down prices and damaging the profitability of almost all Mediterranean fish farming companies, particularly in Greece. It was also explained that Türkiye's increasing sales of sea bream and sea bass fillets, particularly to Northern Europe, is due to Türkiye's high level of adaptation success in meeting consumer preferences for ready-to-eat products (FAO 2019a). It was explained that these import increases to Greece indicate that the Greek domestic market's

resistance to more attractive price levels is weakening, while in Türkiye, unhealthy inflation and a heavy debt burden stand as barriers to further investment and are becoming increasingly conservative in business planning (FAO 2019b).

It is clearly indicated in Table 1 that in 2019, 0302 (fresh or chilled fish excluding fish fillets and other fish meat) were the most exported products to the EU. And it was followed by 0304 (fish fillets and other fish meat (whether or not minced), fresh, chilled or frozen) and 0303 (fish, frozen, excluding fish fillets and other fish meat) and 0305 (Fish, dried, salted or in brine; smoked fish, whether or not cooked before or during the smoking process; flours, meals and pellets, of fish fir for human consumption) respectively. We exported our seafood products mostly to Netherlands, Italy, Greece, Germany and the United Kingdom, respectively. And we didn't export to Luxemburg, Cyprus, Ireland (TÜİK 2021).

Table 1- Seafood export figures (on harmonized tariff schedule number basis) to the EU in 2019

	0106	*0208*	*0301*	*0302*	*0303*	*0304*	*0305*	*0306*	*0307*	*0308*	*1604*	*1605*	*TOTAL ($)*
France	253 462	1 494 598		6 390 587	3 052 528	5 165 985	10 265		2 821 728		3 578 188	3 931 613	**26 698 954**
Netherlands			33 206	50 297 930	1 926 096	87 598 217	2 136 347	101 873			16 530		**142 110 199**
Germany				7 463 574	20 325 673	6 080 235	35 203 770	10 126			434 590	79 963	**69 597 931**
İtaly	286 974	884 706	22 504	60 907 327	2 106 266	35 684 143	104 315	1 732 175	550 116	122 111	1 763 249	6 650 617	**110 814 503**
United Kingdom				25 281 110	679 760	38 873 832	75 426				112 423		**65 022 551**
Denmark				595 896	546 378	697 239	319 568	155 184					**2 314 265**
Greece				52 064 179	202 887	15 679 197	82 948	125 568	2 657 918	43 612	125 830	161 910	**71 144 049**
Portugal				14 025 112	811 393								**14 836 505**
Spain		24 567		34 680 690	838 982	870 222		3 492 494	157 388		398 418	2 969 475	**43 432 236**
Belgium				69 828	217 609	179 415	108 899	150 933	548	118	3 896 421	123 280	**4 747 051**
Sweden					38 849						94 565	4 703 935	**4 837 349**
Austria				265 457	497 093	1 136 574	66 472					1 100	**1 966 696**
Estonia				56 649									**56 649**
Latvia											13 884		**13 884**
Lithuania				2 211 498					393 088				**2 604 586**
Poland				303 806	2 444 752	396 661	514 964						**3 660 183**
Czech Republic					1 748 938	707 660	27 798		387 319				**2 871 715**
Slovakia					133 383								**133 383**
Hungary					395 224	6 385						268 814	**670 423**
Romania				5 368 485	3 079 333	1 608 404	126 267		150		51 863		**10 234 502**
Bulgaria				1 187 447	707 562	90 139					7 360		**1 992 508**
Slovenia					786 562	410 966					4 318		**1 201 846**
Croatia					895 857	65 763					13 199		**974 819**
Finland											1 000		**1 000**
Malta											7 771		**7 771**
TOTAL	**540 436**	**2 403 871**	**55 710**	**261 169 575**	**41 435 125**	**195 251 037**	**38 777 039**	**5 768 353**	**6 968 255**	**165 841**	**10 519 609**	**18 890 707**	**581 945 558**

Source: TÜİK 2021

2. Material and Methods

Processing facilities that received seafood export permits to the EU from The Ministry of Agriculture and Forestry and produce their products with the standards of the EU constituted the limits of our research. Of 111 facilities in 26 provinces that received export permission to the EU, as published on the official website of The Ministry of Agriculture and Forestry in 2018, 73 companies answered the surveys.

The general export information in the questionnaire was invented by Taşçıoğlu (2003). The scales related to export information sources and export market information were developed in accordance with the research purpose by utilizing Kartal (2006), and so did the scale related to export performance by utilizing Yalçın (2015). In the scales used, each item is tested with a 5-point Likert scale which expressions are 'Strongly Disagree, Disagree, Unsure, Agree, Strongly Agree" (Kartal 2006; Yalçın 2015). Multiple-choice questions and open-ended questions are also in questionnaire. Since the survey studies started to be implemented in the second half of 2019, the Ethics Committee Approval was not obtained based on the ULAKBIM decision dated February 25, 2020.

In this research, statistical analyses of the survey results were carried out using the SPSS Statistics 23 package program. Cronbach's Alpha coefficient (ά) was used to test reliability and consistency in Likert-type measurements (Uzgören 2012). Kaiser-Meyer-Olkin (KMO) coefficient and Bartlett Sphericity Test was used to examine whether the variables to be used as data have a statistically significant relationship at a level that can be used for factor analysis. The KMO ratio should be above 0.5 (Kalaycı 2010). Exploratory factor analysis was used to determine the dimensions and number of dimensions in which the export market factors scales collected (Büyüköztürk 2002; Alpar 2017). Whether the dimensions and export performance are normally distributed or not was tested with the Kolmogorov Smirnov Test at the 0.05 level of significance. Whether the export market factors and export performance in the research differ according to business characteristics or not is tested with Kruskal-Wallis Test (Çakıcı et al. 2020). In the study, the p value of Fisher's Exact Test was examined to understand whether the various characteristics of the enterprises are independent of each other. If the P value is >0.05, it is considered independent (Kılıç 2016).

Many models have been developed in Data Envelopment Analysis (DEA). The most widely used among them are Charnes-Cooper-Rhodes (CCR) and Banker-Charnes-Cooper (BCC) models. The CCR model assumes constant returns to scale, while the BCC model considers variable returns to scale (İşbilen-Yücel 2015).

In this study, DEA was conducted with the most widely used input-oriented CCR (was developed by Charnes, Cooper and Rhodes) model and output-oriented CCR model. The data obtained were evaluated using the EMS version 1.3 package program (Demirci 2018). The efficiency score of the enterprises was accepted as 1. According to these figures, it is stated which enterprises are working effectively and which enterprises should take reference to which enterprises to increase their efficiency (Özkan & Özcan 2018).

Efficiency assessment was made based on the relationships between inputs determined as "G1 number of employees", "G2 production capacity", "G3 production percentage of total production capacity" and outputs "C1 export percentage of production amount", "C2 export amount (tons)", "C3 percentage of product loss during packaging", "C4 percentage of product loss after storage", "C5 percentage of product loss during transportation".

3. Results and Discussion

3.1. Survey results

In 2019 and beginning of 2020, 73 of the 111 aquaculture facilities that exported to EU countries accepted to participate in our survey, 49.3% of which were medium-sized (50-249 employees), 41.1% were small-sized (10-49 employees) and 9.6% were large-sized (250 and up employees) enterprises, and 93.2% of these were entirely domestically capitalized. While 94.5% of the enterprises stated that they exported regularly, %5.5 stated that they could not export regularly. 4 enterprises that could not export regularly stated more than 1 reason. The fact that 'Poor organization of the enterprise' was mostly reported by 3 enterprises (Table 2).

Table 2- Reasons why enterprises cannot export regularly

Reasons for export failure	*Frequency* [a]	*Multiple responses %*
Failure to compete in the market in terms of price	2	18.2
Poor organization of the enterprise	3	27.3
Competition between local companies in the same market	1	9.1
Lack of finance	1	9.1
Inadequate market knowledge	2	18.2
Bureaucracy	2	18.2
Total	11	100.0

[a]: Since there are multiple responses, the sampling volume exceeds number of N

It is seen that the enterprises with a capacity of less than 1500 tons/year have the highest share with 43.8%. The ratios of the enterprises with an annual production capacity of 1501-3000 tons and 4501-6000 tons are 15.1% each, and the ratios of the enterprises with an annual production capacity of 3001-4500 tons and 7501 tons and above are 11% each. 4.1% of enterprises have a production capacity of 6001-7500 tons/year.

It was revealed that 45.2% of the enterprises work with 61-90% of their production capacity, while 24.7% of the enterprises work with 91% and above of their production capacity, 23.3% enterprises work with 31-60%, and 6.8% enterprises work with 30% and below of their production capacity.

It was determined that 32.9% of the enterprises exported 61-90% of their production, 26% of the enterprises exported 91% and above, 24.7% exported 30% and below, and 16.4% exported 31-60% of their production.

As indicated in Table 3, enterprises encountered more than one problem while supplying the raw materials. 'Shortage of raw materials' and 'Expensive materials' each were mentioned by 29 enterprises. 'Failure to find products on time/No fish out of season' was told by 18 enterprises. To supply of raw materials or supplying them on time affects the production amount. Businesses attributed the inability to find raw materials in fishing products on time to the problem of sustainable fishing. In order to protect the stocks, they emphasized that more comprehensive prohibitions in the implementation of Fisheries Law No. 1380 to ensure sustainable fisheries could increase natural fish exports in the coming years. Some businesses argued that there will be an increase in coastal fisheries by opening the way for offshore fishing. Köse et al. (2010) reported that shortage of raw material is an important problem and that companies even cited shortage of raw material as the reason for low capacity operation. Similarly, so did Mol & Ulusoy (2010).

Both high raw materials and production costs have emerged in our research as one of the important problems that negatively affect competition. Turgay (2017), Köse et al. (2010), Avşan (2014) mentioned that the cost of raw materials affects competition. Mol & Ulusoy (2010) mentioned the need for low-interest loans and tax reductions in the sector.

Table 3- Problems encountered during product supply

Problems encountered during raw materials supply	*Frequency* [a]	*Multiple Responses %*
Inadequate quality	7	5.1
Climatic Conditions	3	2.2
Shortage of raw materials	29	21.3
Failure to find products on time/No fish out of season	18	13.2
Inappropriate Fish Sizes	3	2.2
Expensive materials	29	21.3
Problems in Transportation of Raw Materials	3	2.2
Prohibitions / Procedural Challenges	11	8.1
The Problem of Investment Areas	2	1.5
Packaging Problem	1	0.7
Price Imbalance / Competition	12	8.8
No problem	18	13.2
Total	136	100.0

[a]: Since there are multiple responses, the sampling volume exceeds number of N

Heal & Schelenker (2008) argue that fishermen's goals of increasing catches are in conflict with the goal of conserving fish stocks by limiting fishing.

In Türkiye's fisheries policies, it is seen that more detailed policies need to be prepared and implemented on fishing. Due to the fact that many fish species move across the borders of different countries, measures should be taken to encourage offshore fishing in order to protect our rights (Tiryakioğlu & Dellal 2012).

Enterprises have more than one processing types. Considering in terms of number of enterprises not enterprises tonnage sizes, mostly used processing types are 95.9% frozen processing, 82.2% fresh chilled, 35.6% marinat technology while 32.9% smoking. 20.5% can also produce with a way of canning technology.

Enterprises exported a wide variety of products. Trout, sea bream, sea bass and anchovies are the products most frequently exported by the companies. Octopus, shrimp, Turkish salmon, haddock, cod, calamari, mussels, snails, mackerel, bonito, tuna, crab were also indicated many times by the companies.

Among the enterprises participating in the survey, 49.3% have the highest share with 0-500 tons/year export amount. While the rate of enterprises exporting 3001 tons/year and above is 16.4%, exporting 501-1000 tons/year is 15.1%, 1001-1500 tons/year is 11%. 1501-2000 tons/year is 4.1%, 2001-2500 tons/year is 2.7%. 2501-3000 tons/year is 1.4%.

Only 6.8% of the enterprises stated that they had problems in packaging. These problems are quality deterioration, certification of bags/nylon, bags cutting defects, delayed delivery of packaging. 41.1% of the enterprises experienced 1% product loss during packaging, while the rate of enterprises that did not experience any product loss was 39.7.

63% of the enterprises participating in the research stated that they had problems in product transportation. These problems were mentioned in Table 4. Finding enough space for transportation on time and high freight prices are issues.

There are many problems experienced at the border checkpoints. Sometimes waiting times caused extra correspondence to explain to the customer and costs. Köse et al. (2010) stated that the problems experienced by the enterprises using imported raw materials at customs from time to time deteriorate the quality of raw materials and disrupt production. Köse et al. (2010), Turgay (2017) stated the excessive number of documents required at customs and the necessity to obtain approval from different units should be reduced.

Table 4- Problems might be encountered in product transportation

Problems might be encountered in transportation	*Frequency* [a]	*Multiple responses%*
On time delivery /Late entry of products into the market	27	30.0
Cold chain break	12	13.3
Package deformation	4	4.4
Price reductions when quality deteriorates	9	10.0
Congestion at customs/ border checkpoint	17	18.9
The space shortage in transportation (Especially in air freight)	21	23.3
Total	90	100.0

[a]: Since there are multiple responses, the sampling volume exceeds number of N

Competition, price disagreement, and tax policy of import countries are the most problems indicated in products sales (Table 5). Anti-dumping practices, which had been announced to protect producers by stating they negatively affected EU producers, made it difficult for our producers to compete due to high taxes.

Table 5- Problems arising in product sales

Product sales problems	*Frequency* [a]	*Multiple Responses %*
Price disagreement	18	13.5
Inability to Produce on Time	14	10.5
Foreign currency fluctuations	12	9.0
Failure to collect money	3	2.3
Foreign dumping practices	8	6.0
Competition	25	18.8
Lack of Confidence of the Company	3	2.3
Tax Policy of the buying country	19	14.3
Logistics	10	7.5
No problem	21	15.8
Total	133	100.0

[a]: Since there are multiple responses, the sampling volume exceeds number of N

Competition-based pricing (selling the products not at the desired price) was one of the important problems. Some enterprises believe that a value-based pricing policy will eliminate competition-based problems in purchases and sales. Duyar (2016) emphasized that after a good cost analysis, quality-based product sales system should be established rather than competition.

Cronbach's Alpha test was used to test whether the statements related to export market factors, export information sources, export performance were understood by the respondents and the results were given in Table 6. Since items 2 statements were removed from the export market factors scale after the factor analysis, the scale was tested again and it is seen that while the result of the reliability analysis (Cronbach's Alpha value) of the 13-item scale was 65.1, the new analysis result of the 11-item export market factors increased to 66.4.

Table 6- Reliability test of the scales

Scale	*Number of statements*	*Cronbach's Alpha*
Export market factors	13	0.651
Export information sources	19	0.841
Export performance	4	0.775

In order to determine whether the statements in the questionnaire are suitable for factor analysis, the Kaiser-Meyer-Olkin (KMO) ratio should be above 0.5 (Kalaycı 2010: 322). According to the results of the KMO test in Table 7, the factor analysis can be performed with the scales in the study and the scales have a statistically significant relationship. A high alpha coefficient means that the items in that scale are consistent with each other and work together (Alpar 2017).

Table 7- Kaiser-Meyer-Olkin (KMO) and Bartlett's test of Sphericity

KMO and Barlett's Test		*Export market factors*	*Export performance*
(KMO) Measurement Test of Sampling Adequacy		0.636	0.617
	Approximate Chi-Square	439.109	108.425
Barlett's Test	df	78	6
	Sig.	0.000	0.000

It is understood from Table 8 that export market factors (competition, technology, customer, laws) are not normally distributed since P<0.05, therefore non-parametric tests were applied.

Table 8- Testing the normal distribution of export market factors (Kolmogorov Smirnov Test)

Scale	*Competition*	*Technology*	*Customer*	*Laws*
Kolmogorov Smirnov Z	0.140	0.151	0.274	0.243
Asymp. Sig. (P)	0.001	0.000	0.000	0.000

The Kruskal-Wallis test, one of the non-parametric tests, was used to test whether there is a difference in the export market scale, which are competition, technology, customer, and legislation according to enterprise size, periods of activity, exporting periods and the capital structure of the enterprises (Table 9).

Table 9- Test of the differences of export market factors in terms of business characteristics

Business characteristics	*Test measurement*	*Competition*	*Technology*	*Customer*	*Laws*
	χ^2	0.802	2.668	2.680	1.438
Enterprise size	df	2	2	2	2
	Asymp Sig. (P)	0.670	0.263	0.262	0.487
	χ^2	2.755	7.574	2.296	2.649
Periods of activity	df	5	5	5	5
	Asymp Sig. (P)	0.738	0.181	0.807	0.754
	χ^2	1.165	7.719	5.292	6.985
Exporting periods	df	5	5	5	5
	Asymp Sig. (P)	0.948	0.172	0.381	0.222
	χ^2	3.846	1.069	1.230	7.433
Capital structure	df	3	3	3	3
	Asymp Sig. (P)	0.279	0.785	0.746	0.059

Table 10- Testing the differences in export performance in terms of business characteristics

Business characteristics	*Test measurement*	*Export performance*
	χ^2	1.562
Enterprise size	df	2
	Asymp Sig. (P)	0.458
	χ^2	7.100
Periods of activity	df	5
	Asymp Sig. (P)	0.213
	χ^2	8.982
Exporting periods	df	5
	Asymp Sig. (P)	0.110
	χ^2	3.443
Capital structure	df	3
	Asymp Sig. (P)	0.328

The Kruskal-Wallis test was also used to test whether the export performance scale differs according to the enterprise size, periods of activity, exporting periods and the capital structure of the enterprises (Table 10). Since the result of the test was P>0.05, it was determined that there were no differences.

3.2. Data envelopment analysis (DEA)

Appendix 1 shows the efficiency percentages of enterprises based on input factors. For each enterprise that did not achieve an efficiency score, the enterprises they should refer to and the outputs they should apply according to their inputs are indicated.

The average efficiency score of the enterprises is 69.46%. Accordingly, 15 enterprises (3, 4, 5, 8, 9, 14, 20, 23, 28, 32, 34, 41, 42, 50, 69) are 100% efficient corresponding to 20.5% of the total enterprises participating in our survey. And 58 enterprises are below the average efficiency score. Seki & Akbulut (2015), in their DEA study, stated that enterprises in the TR22 region consisting of Çanakkale and Balıkesir cannot use their resources well. If enterprises do not use their resources effectively, they may face many market, financial and other problems that can affect their existence.

Explaining Appendix 1 with 2 examples, enterprise 5 which is 100% efficiency was referenced 6 times. 100% efficiency was achieved with the input "production capacity (G2)" with a ratio of 0.16, the input "production percentage of total production

capacity (G3)" with a ratio of 0.84, the output "export percentage of production amount (C1)" with a ratio of 0.74, the output "export amounts (C2)" with a ratio of 0.1 and the output "percentage of product loss during transportation (C5)" with a ratio of 0.16.

The efficiency score of the 71st enterprise, which is above the average efficiency score, is 97.44%. This efficiency was achieved with input "number of employees (G1)" with a ratio of 0.57, input "production percentage of total production capacity (G3)" with a ratio of 0.43, output "export amounts (C2)" with a ratio of 0.97 and output "percentage of product loss during packaging (C3)" with a ratio of 0.03. According to the experimental test results, in order to increase the efficiency, Enterprise 9 should be taken as a reference with a ratio of 0.02, Enterprise 41 with a ratio of 0.07 and Enterprise 42 with a ratio of 0.89. In order to be efficient, 1338 units of "(G2)" input should be increased and 19.17% of "export percentage of production amount (C1)" output should be increased.

The enterprises were subjected to output-oriented CCR DEA with the same data and the results are given in Appendix 2. The efficiency score is accepted as "1" and according to the output-oriented CCR model, the average efficiency score of the enterprises is 189.69%. Accordingly, 15 enterprises are 100% efficient and according to the results of the analysis, enterprises 3, 4, 5, 8, 9, 14, 20, 23, 28, 32, 34, 41, 42, 50, 69 are 100% efficient.

In the study, the 37th enterprise, which did not achieve the average efficiency score and was the furthest away from the efficiency score, had the highest score with an efficiency score of 1019.43%. The inputs "number of employees (G1)" with a rate of 4%, "production capacity (G2)" with a rate of 0.55, "production percentage of total production capacity (G3)" with a rate of 0.41, "export percentage of production amount (C1)" with a rate of 0.33, "export amount (C2)" with a rate of 0.63, "percentage of product loss after storage (C4)" with a rate of 0.04 were effective in obtaining this score. In order to achieve efficiency, the 8th enterprise with a ratio of 0.51, 14th enterprise with a ratio of 0.50, 23rd enterprise with a ratio of 0.09, 32nd enterprise with a ratio of 0.12 and 41st enterprise with a ratio of 0.07 should be taken as reference. According to the experimental test results, the output "percentage of product loss during packaging (C3)" should be reduced by 2.85% and the output "percentage of product loss during transportation (C5)" should be reduced by 0.55%.

3.3. Other export problems and solution proposal identified by the enterprises

It was underlined that there is a problem in the distribution of catching quotas which is determined by international agreements. Export amount will increase with the increase in the country's quota as long as the country is ready for production.

Production costs of imported raw materials increases due to the foreign exchange currency. And also the production costs reduce the chance to compete abroad. It was emphasized that improvements and discounts in various taxes and cheap fuel for transportation should be emphasized.

It was stated that there is a major problem called competition-based pricing. It is caused by the pricing made by importing companies by following the exchange rate in our country and also caused by price pressure on sales due to domestic and international competition.

Procedural problems were notified as an extra problem. Some export documents need to be completed at the provincial directorates, It was shared that the existence of customs offices in wholesale fish market or authorizing the districts would make easier to complete the export paperwork. By this means, it ensures that fresh products enter the customs on time and prevents the importer from breaking the price by claiming the freshness of the products.

Companies criticized that commercial attachés are not active, do not share regional researches. It was mentioned that more active attachés, making accessible detailed studies about the region would make easier to enter new markets.

4. Conclusions

Seafood production and trade have increased in Türkiye and marked by an increase in exports to non-EU markets. This development reduces export dependence on limited countries.

The fact that none of the hypotheses were confirmed indicates that enterprises in all categories face similar problems, most of which are external.

According to DEA, 20.5% of surveyed enterprises operate 100% effectively.

Export countries diversification is an effective solution to be less affected by tax policies of the countries. Effective political agreements with the countries are among the solutions. Enhancing aquaculture product diversity across various export destinations reduces the sector's fragility in the foreign market and secures sustained export flows through.

Timely and consistent raw material supply affects the production amount and one of the reasons for low capacity operation. For the sustainability of fish stocks resource management protocols, including fishing bans and quota determination by Ministry should be properly implemented.

High input costs (raw materials, production and transportation) have emerged in the research as one of the important problems that negatively affect competition. Low-interest loans and tax reductions in the sector will revitalize the sector.

Scarcity of timely transport capacity (particularly for air cargo) high freight costs are issues. Agreements with the Authorities for certain periods will minimize the problem.

Competition-based pricing was found to be one of the important problems. Value-based pricing policy will eliminate competition-based problems in purchases and sales.

At the border checkpoint, bureaucracy should be minimized, requiring integrated systems for documents among customs organizations to expedite transactions. This would mitigate losses from customs delays (e.g., late delivery, quality deterioration, price reduction).

To overcome bureaucratic obstacles in the buyer countries, enterprises suggested senior officials should be more effective. Trade attachés and other foreign representative offices should be actively contribute to regional market research. Determining trends, needs and demands of the regions and publishing sector-specific studies in the regions will provide a great advantage in entering the market.

The Ministry of Agriculture and Forestry implemented sustainable fishing quota system for anchovies, which are the most commonly fished species in our country, starting 2024 adding to existing quotas for certain species (Özkan 2024).

Author Declarations

Authors' contributions: Concept: S.Ö., F.Ş., Design: S.Ö., F.Ş., A.O., Data collection: S.Ö., Analysis: S.Ö., A.O., Writing: S.Ö., F.Ş.

Conflict of interest/Competing interests: The author(s) declare no conflict of interest.

Ethics approval/declarations: Since the survey studies had started before the Ethics Committee Approval reguirement came into effect, there is no Ethics Committee Approval.

Funding: This research received no external funding.

Consent to participate: No need/ Not applicable.

Consent for publication: No need/ Not applicable.

Data availability: Data are available on request due to privacy or other restrictions.

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Appendix 1- Input oriented CCR- DEA

Enterprises	Score	G1 {I}{V}	G2 {I}{V}	G3 {I}{V}	C1 {O}{V}	C2 {O}{V}	C3 {O}{V}	C4 {O}{V}	C5 {O}{V}	Benchmarks	{S} G1 {I}	{S} G2 {I}	{S} G3 {I}	{S} C1 {O}	{S} C2 {O}	{S} C3 {O}	{S} C4 {O}	{S} C5 {O}
1	43.28%	0	0.46	0.54	0.6	0.4	0	0	0	3 (0.58) 5 (0.31) 41 (0.10)	53.41	0	0	0	0	1.73	0.16	0.93
2	68.99%	0	0.64	0.36	0.37	0.63	0	0	0	32 (0.62) 41 (0.13) 50 (0.19)	18.82	0	0	0	0	0.86	0.62	2.86
3	100.00%	0.07	0	0.93	0.9	0	0.08	0.02	0	16								
4	100.00%	0	0.06	0.94	0	0.02	0	0.1	0.88	6								
5	100.00%	0	0.16	0.84	0.74	0.1	0	0	0.16	6								
6	32.95%	0	0.51	0.49	0.53	0.47	0	0	0	32 (0.25) 41 (0.02) 50 (0.09)	5.62	0	0	0	0	0.74	0.25	1.17
7	78.30%	0	0.14	0.86	0.94	0	0	0.06	0	3 (0.05) 8 (0.14) 50 (0.42)	6.72	0	0	0	53.6	0.16	0	0.85
8	100.00%	0	0.88	0.12	0	0	0	1	0	13								
9	100.00%	0	0	1	0	0.2	0.8	0	0	20								
10	44.20%	0.87	0.09	0.04	0.3	0.33	0.37	0	0	20 (0.17) 23 (0.04) 34 (0.09) 50 (0.05) 69 (0.09)	0	0	0	0	0	0	0.13	0.23
11	92.62%	0	0.44	0.56	0.62	0.38	0	0	0	32 (0.71) 41 (0.04) 50 (0.28)	40.45	0	0	0	0	2.13	0.71	3.39
12	77.97%	0	0.48	0.52	0.58	0.4	0.01	0	0	5 (0.72) 9 (0.13) 41 (0.01) 50 (0.21)	122.05	0	0	0	0	0	0	2.57
13	22.47%	1	0	0	0.16	0	0	0.27	0.57	4 (0.05) 8 (0.00) 50 (0.04)	0	51.97	9.56	0	10.58	0.05	0	0
14	100.00%	0	0.9	0.1	0	0.95	0.02	0.02	0	15								
15	80.84%	0.7	0	0.3	0	0.97	0.02	0.01	0	8 (0.03) 9 (0.02) 41 (0.34) 42 (0.52)	0	576.7	0	20.77	0	0	0	0
16	49.79%	0	0.39	0.61	0	0	0.34	0	0.66	4 (0.50) 9 (0.02) 20 (0.38)	3.99	0	0	31.16	175.41	0	10	0
17	52.70%	0.82	0.1	0.08	0.38	0.28	0.23	0.1	0	8 (0.03) 20 (0.07) 23 (0.01) 34 (0.10) 50 (0.11) 69 (0.11)	0	0	0	0	0	0	0	0.33
18	46.06%	0	0.62	0.38	0.41	0.58	0.01	0	0	8 (0.02) 9 (0.03) 32 (0.26) 41 (0.04) 50 (0.18)	113.95	0	0	0	0	0	0	1.4
19	52.62%	0	0.4	0.6	0.63	0.37	0	0	0	32 (0.57) 41 (0.03) 50 (0.11)	18.5	0	0	0	0	1.72	0.57	2.52
20	100.00%	0	0.46	0.54	0	0	1	0	0	6								
21	81.55%	0	0.22	0.78	0.84	0.16	0	0	0	32 (0.67) 41 (0.01) 50 (0.14)	3.31	0	0	0	0	1.01	0.67	0.95
22	85.80%	0	0.67	0.33	0.45	0.55	0	0	0	32 (0.12) 41 (0.09) 50 (0.88)	27.55	0	0	0	0	0.36	0.12	2.23
23	100.00%	0.17	0.81	0.01	0.06	0.94	0	0	0	8								
24	59.37%	0	0.55	0.45	0.66	0.34	0	0	0	32 (0.07) 41 (0.02) 50 (0.59)	16.37	0	0	0	0	0.21	0.07	1.44
25	86.93%	0	0.97	0.03	0.11	0.89	0	0	0	14 (0.47) 32 (0.50) 34 (0.05)	2.71	0	0	0	0	3.95	2.9	1.05
26	68.38%	0	0.48	0.52	0.47	0.53	0	0	0	3 (0.08) 5 (0.68) 41 (0.20)	22.93	0	0	0	0	0.24	0.16	2.04
27	88.99%	0	0.81	0.19	0.15	0.85	0	0	0	14 (0.24) 32 (0.30) 41 (0.39)	183.52	0	0	0	0	2.13	1.52	1.2
28	100.00%	0	0.43	0.57	0	0.22	0.21	0	0.58	0								

Appendix 1- Input oriented CCR-DEA (Continued)

Enterprises	Score	G1 {I}{V}	G2 {I}{V}	G3 {I}{V}	C1 {O}{V}	C2 {O}{V}	C3 {O}{V}	C4 {O}{V}	C5 {O}{V}	Benchmarks	{S} G1 {I}	{S} G2 {I}	{S} G3 {I}	{S} C1 {O}	{S} C2 {O}	{S} C3 {O}	{S} C4 {O}	{S} C5 {O}
29	75.38%	0.24	0.73	0.02	0.14	0.86	0	0	0	14 (0.20) 23 (0.12) 32 (0.44) 34 (0.06)	0	0	0	0	0	1.45	0.64	0.94
30	77.81%	0	0.26	0.74	0.68	0.32	0	0	0	14 (0.23) 32 (0.67) 41 (0.01)	26.72	0	0	0	0	2.14	0.8	1.66
31	81.16%	0.02	0.36	0.62	0.7	0.29	0	0.01	0	3 (0.06) 5 (0.69) 8 (0.03) 9 (0.02) 41 (0.03) 50 (0.14)	0	0	0	0	0	0	0	1.37
32	100.00%	0	0.59	0.41	0	0	0	0	1	29								
33	62.57%	0	0.41	0.59	0.52	0.48	0	0	0	14 (0.22) 32 (0.46) 41 (0.03)	8.46	0	0	0	0	1.46	0.55	0.83
34	100.00%	0.31	0.69	0	0.93	0	0	0.07	0	5								
35	71.57%	0.03	0.87	0.1	0	0.97	0	0	0.03	14 (0.13) 23 (0.42) 32 (0.14) 41 (0.04)	0	0	0	3.68	0	0.11	0.24	0
36	43.17%	0.56	0	0.44	0.29	0.67	0.05	0	0	3 (0.23) 9 (0.01) 41 (0.08) 42 (0.12)	0	455.8	0	0	0	0	0.46	0
37	9.81%	0.04	0.55	0.41	0.33	0.63	0	0.04	0	8 (0.05) 14 (0.05) 23 (0.01) 32 (0.01) 41 (0.01)	0	0	0	0	0	0.28	0	0.05
38	64.55%	0	0.28	0.72	0.57	0	0.26	0	0.17	3 (0.01) 4 (0.02) 5 (0.20) 9 (0.05)	107.81	0	0	0	332.69	0	0.42	0
39	27.36%	0	0.41	0.59	0.52	0.46	0.01	0	0	9 (0.00) 14 (0.06) 32 (0.22) 41 (0.01)	10.5	0	0	0	0	0	0.53	0.9
40	48.01%	0.55	0	0.45	0.52	0.36	0.12	0	0	20 (0.10) 23 (0.10) 42 (0.00) 50 (0.38)	0	48.51	0	0	0	0	0.1	0.87
41	100.00%	0	0	1	0	1	0	0	0	44								
42	100.00%	0.66	0	0.34	0	1	0	0	0	13								
43	66.62%	0	0.27	0.73	0.72	0.28	0	0	0	14 (0.02) 32 (0.67) 41 (0.02)	4.62	0	0	0	0	2.09	0.75	2.67
44	49.00%	0	0	1	0.46	0	0	0	0.54	3 (0.08) 4 (0.10)	1.08	1560	0	0	20.9	0.33	2.15	0
45	74.82%	0	0	1	0.75	0.15	0	0	0.1	3 (0.91) 4 (0.10) 41 (0.05)	106.7	902.4	0	0	0	1.82	3.82	0
46	94.15%	0.6	0	0.4	0	0.92	0.07	0.01	0	8 (0.03) 9 (0.07) 41 (0.06) 42 (0.82)	0	1196	0	17.61	0	0	0	0
47	35.69%	0.57	0	0.43	0.25	0.52	0.11	0	0.12	3 (0.04) 4 (0.05) 9 (0.02) 41 (0.02) 42 (0.02) 50 (0.04)	0	3482	0	0	0	0	0	0
48	22.15%	1	0	0	0.32	0.23	0	0.44	0	8 (0.03) 50 (0.01) 69 (0.09)	0	164.1	8.83	0	0	0.09	0	0.02
49	75.14%	0.38	0	0.62	0.39	0.6	0	0.01	0	3 (0.27) 8 (0.01) 41 (0.01) 42 (0.43)	0	755	0	0	0	0.8	0	0
50	100.00%	0.71	0	0.29	0.91	0.09	0	0	0	25								
51	34.55%	0	1	0	0.01	0.66	0	0.12	0.21	8 (0.02) 14 (0.01) 32 (0.23) 34 (0.08)	11.49	0	5.56	0	0	0.92	0	0
52	87.60%	0.63	0	0.37	0	0.83	0.16	0.02	0	3 (0.03) 9 (0.03) 20 (0.18) 42 (0.59)	0	537	0	5.72	0	0	0	0

Appendix 1- Input oriented CCR-DEA (Continued)

Enterprises	Score	G1 {I}{V}	G2 {I}{V}	G3 {I}{V}	C1 {O}{V}	C2 {O}{V}	C3 {O}{V}	C4 {O}{V}	C5 {O}{V}	Benchmarks	{S} G1 {I}	{S} G2 {I}	{S} G3 {I}	{S} C1 {O}	{S} C2 {O}	{S} C3 {O}	{S} C4 {O}	{S} C5 {O}
53	50.26%	0	0.6	0.4	0.57	0.43	0	0	0	32 (0.08) 41 (0.03) 50 (0.56)	11.35	0	0	0	0	0.24	0.08	0.43
54	82.00%	0	0.28	0.72	0.71	0.29	0	0	0	14 (0.04) 32 (0.85) 41 (0.02)	15.73	0	0	0	0	1.76	1.06	3.39
55	86.48%	0	0.3	0.7	0.75	0.25	0	0	0	32 (0.75) 41 (0.02) 50 (0.16)	30.01	0	0	0	0	2.24	0.75	3.31
56	93.18%	0	0.84	0.16	0.12	0.88	0	0	0	14 (0.23) 32 (0.21) 41 (0.52)	13.13	0	0	0	0	0.78	0.36	0.83
57	94.19%	0.75	0	0.25	0	0.98	0.02	0.01	0	8 (0.03) 9 (0.03) 41 (0.53) 42 (0.39)	0	2124	0	16.64	0	0	0	0
58	89.96%	0.03	0.81	0.16	0.13	0.87	0	0	0	14 (0.09) 23 (0.28) 32 (0.21) 41 (0.37)	0	0	0	0	0	0.06	0.92	1.12
59	38.03%	0	0.47	0.53	0.6	0.39	0.01	0	0	9 (0.01) 32 (0.23) 41 (0.02) 5((0.16)	8.4	0	0	0	0	0	0.23	1.26
60	12.59%	0	0.49	0.51	0.48	0.52	0	0	0	3 (0.04) 5 (0.09) 41 (0.03)	20.08	0	0	0	0	0.12	0.08	0.27
61	60.42%	0	0.36	0.64	0.75	0.25	0	0	0	32 (0.36) 41 (0.01) 50 (0.27)	49.86	0	0	0	0	0.08	0.36	1.97
62	59.96%	0	0	1	0.5	0.48	0.02	0	0	3 (0.20) 9 (0.01) 41 (0.12)	170.84	6994	0	0	0	0	0.39	0
63	18.26%	0	0.61	0.39	0.44	0.56	0	0	0	32 (0.11) 41 (0.02) 50 (0.08)	33.56	0	0	0	0	0.33	0.11	0.6
64	27.24%	0.35	0.17	0.48	0.42	0.51	0.08	0	0	3 (0.05) 9 (0.02) 41 (0.00) 42 (0.08) 50 (0.18)	0	0	0	0	0	0	0.09	0.36
65	60.15%	0.04	0.73	0.24	0.18	0.81	0	0	0	9 (0.01) 14 (0.11) 23 (0.33) 32 (0.08) 41 (0.09)	0	0	0	0	0	0	0.95	0.66
66	42.82%	0.44	0	0.56	0.27	0.67	0.06	0	0	3 (0.06) 9 (0.02) 41 (0.01) 42 (0.25)	0	671.7	0	0	0	0	0.12	0
67	37.63%	0.45	0	0.55	0.69	0.29	0.02	0	0	3 (0.33) 41 (0.01) 42 (0.00) 50 (0.04)	0	190.1	0	0	0	0	0.67	0.07
68	89.14%	0	0.37	0.63	0.75	0.25	0	0	0	32 (0.51) 41 (0.02) 50 (0.42)	20.07	0	0	0	0	1.54	0.51	2.9
69	100.00%	1	0	0	0.21	0.65	0.14	0	0	3								
70	88.33%	0	0.6	0.4	0.32	0.68	0	0	0	14 (0.45) 32 (0.35) 41 (0.11)	36.52	0	0	0	0	3.33	2.63	1.42
71	97.44%	0.57	0	0.43	0	0.97	0.03	0	0	9 (0.02) 41 (0.07) 42 (0.89)	0	1338	0	19.17	0	0	0	0
72	82.94%	0.67	0	0.33	0	0.98	0.02	0	0	9 (0.03) 41 (0.23) 42 (0.59)	0	261.2	0	0.97	0	0	0	0
73	44.64%	0.42	0	0.58	0.48	0	0.52	0	0	3 (0.09) 9 (0.02) 20 (0.01)	0	1535	0	0	94.56	0	0.17	0

Inputs: G1: number of employees, G2: production capacity, G3: production percentage of total production capacity
Outputs: C1: export percentage of production amount, C2: export amount (tons), C3: percentage of product loss during packaging, C4: percentage of product loss after storage", "C5 percentage of product loss during transportation".

Appendix 2- Output oriented CCR-DEA

Enterprises	Score	G1 {I}{V}	G2 {I}{V}	G3 {I}{V}	C1 {O}{V}	C2 {O}{V}	C3 {O}{V}	C4 {O}{V}	C5 {O}{V}	Benchmarks	{S} G1 {I}	{S} G2 {I}	{S} G3 {I}	{S} C1 {O}	{S} C2 {O}	{S} C3 {O}	{S} C4 {O}	{S} C5 {O}
1	231.05%	0	0.46	0.54	0.6	0.4	0	0	0	3 (1.33) 5 (0.71) 41 (0.23)	123.41	0	0	0	0	4	0.36	2.14
2	144.96%	0	0.64	0.36	0.37	0.63	0	0	0	32 (0.90) 41 (0.19) 50 (0.28)	27.28	0	0	0	0	1.24	0.9	4.15
3	100.00%	0.07	0	0.93	0.9	0	0.08	0.02	0	16								
4	100.00%	0	0.06	0.94	0	0.02	0	0.1	0.88	6								
5	100.00%	0	0.16	0.84	0.74	0.1	0	0	0.16	6								
6	303.45%	0	0.51	0.49	0.53	0.47	0	0	0	32 (0.75) 41 (0.07) 50 (0.28)	17.06	0	0	0	0	2.24	0.75	3.54
7	127.71%	0	0.14	0.86	0.94	0	0	0.06	0	3 (0.07) 8 (0.18) 50 (0.54)	8.58	0	0	0	68.45	0.21	0	1.08
8	100.00%	0	0.88	0.12	0	0	0	1	0	13								
9	100.00%	0	0	1	0	0.2	0.8	0	0	20								
10	226.26%	0.87	0.09	0.04	0.3	0.33	0.37	0	0	20 (0.39) 23 (0.09) 34 (0.21) 50 (0.10) 69 (0.19)	0	0	0	0	0	0	0.3	0.51
11	107.97%	0	0.44	0.56	0.62	0.38	0	0	0	32 (0.77) 41 (0.05) 50 (0.30)	43.68	0	0	0	0	2.3	0.77	3.66
12	128.25%	0	0.48	0.52	0.58	0.4	0.01	0	0	5 (0.92) 9 (0.16) 41 (0.02) 50 (0.27)	156.52	0	0	0	0	0	0	3.3
13	445.02%	1	0	0	0.16	0	0	0.27	0.57	4 (0.21) 8 (0.01) 50 (0.17)	0	231.28	42.55	0	47.08	0.21	0	0
14	100.00%	0	0.9	0.1	0	0.95	0.02	0.02	0	15								
15	123.69%	0.7	0	0.3	0	0.97	0.02	0.01	0	8 (0.04) 9 (0.03) 41 (0.42) 42 (0.64)	0	713.28	0	25.7	0	0	0	0
16	200.85%	0	0.39	0.61	0	0	0.34	0	0.66	4 (1.00) 9 (0.04) 20 (0.76)	8.02	0	0	62.58	352.32	0	20.09	0
17	189.76%	0.82	0.1	0.08	0.38	0.28	0.23	0.1	0	8 (0.05) 20 (0.13) 23 (0.03) 34 (0.18) 50 (0.20) 69 (0.21)	0	0	0	0	0	0	0	0.62
18	217.13%	0	0.62	0.38	0.41	0.58	0.01	0	0	8 (0.05) 9 (0.07) 32 (0.56) 41 (0.09) 50 (0.39)	247.42	0	0	0	0	0	0	3.04
19	190.04%	0	0.4	0.6	0.63	0.37	0	0	0	32 (1.09) 41 (0.06) 50 (0.21)	35.16	0	0	0	0	3.28	1.09	4.78
20	100.00%	0	0.46	0.54	0	0	1	0	0	6								
21	122.63%	0	0.22	0.78	0.84	0.16	0	0	0	32 (0.82) 41 (0.01) 50 (0.17)	4.06	0	0	0	0	1.24	0.82	1.17
22	116.55%	0	0.67	0.33	0.45	0.55	0	0	0	32 (0.14) 41 (0.10) 50 (1.02)	32.11	0	0	0	0	0.42	0.14	2.6
23	100.00%	0.17	0.81	0.01	0.06	0.94	0	0	0	8								
24	168.44%	0	0.55	0.45	0.66	0.34	0	0	0	32 (0.12) 41 (0.03) 50 (0.99)	27.57	0	0	0	0	0.35	0.12	2.43
25	115.03%	0	0.97	0.03	0.11	0.89	0	0	0	14 (0.54) 32 (0.58) 34 (0.06)	3.12	0	0	0	0	4.54	3.34	1.21
26	146.24%	0	0.48	0.52	0.47	0.53	0	0	0	3 (0.12) 5 (0.99) 41 (0.29)	33.53	0	0	0	0	0.35	0.23	2.98
27	112.38%	0	0.81	0.19	0.15	0.85	0	0	0	14 (0.28) 32 (0.34) 41 (0.44)	206.23	0	0	0	0	2.39	1.71	1.35
28	100.00%	0	0.43	0.57	0	0.22	0.21	0	0.58	0								
29	132.66%	0.24	0.73	0.02	0.14	0.86	0	0	0	14 (0.27) 23 (0.16) 32 (0.58) 34 (0.08)	0	0	0	0	0	1.92	0.84	1.25

Appendix 2- Output oriented CCR-DEA (Continued)

Enterprises	Score	G1 {I}{V}	G2 {I}{V}	G3 {I}{V}	C1 {O}{V}	C2 {O}{V}	C3 {O}{V}	C4 {O}{V}	C5 {O}{V}	Benchmarks	{S} G1 {I}	{S} G2 {I}	{S} G3 {I}	{S} C1 {O}	{S} C2 {O}	{S} C3 {O}	{S} C4 {O}	{S} C5 {O}
30	128.52%	0	0.26	0.74	0.68	0.32	0	0	0	14 (0.29) 32 (0.86) 41 (0.01)	34.34	0	0	0	0	2.74	1.03	2.14
31	123.21%	0.02	0.36	0.62	0.7	0.29	0	0.01	0	3 (0.07) 5 (0.85) 8 (0.03) 9 (0.03) 41 (0.04) 50 (0.18)	0	0	0	0	0	0	0	1.68
32	100.00%	0	0.59	0.41	0	0	0	0	1	29								
33	159.83%	0	0.41	0.59	0.52	0.48	0	0	0	14 (0.35) 32 (0.73) 41 (0.04)	13.51	0	0	0	0	2.33	0.88	1.32
34	100.00%	0.31	0.69	0	0.93	0	0	0.07	0	5								
35	139.73%	0.03	0.87	0.1	0	0.97	0	0	0.03	14 (0.19) 23 (0.59) 32 (0.20) 41 (0.06)	0	0	0	5.14	0	0.15	0.33	0
36	231.64%	0.56	0	0.44	0.29	0.67	0.05	0	0	3 (0.54) 9 (0.02) 41 (0.18) 42 (0.29)	0	1055.77	0	0	0	0	1.08	0
37	1019.43%	0.04	0.55	0.41	0.33	0.63	0	0.04	0	8 (0.51) 14 (0.50) 23 (0.09) 32 (0.12) 41 (0.07)	0	0	0	0	0	2.85	0	0.55
38	154.93%	0	0.28	0.72	0.57	0	0.26	0	0.17	3 (0.02) 4 (0.03) 5 (0.31) 9 (0.08)	167.03	0	0	0	515.43	0	0.66	0
39	365.53%	0	0.41	0.59	0.52	0.46	0.01	0	0	9 (0.00) 14 (0.23) 32 (0.82) 41 (0.05)	38.37	0	0	0	0	0	1.95	3.28
40	208.29%	0.55	0	0.45	0.52	0.36	0.12	0	0	20 (0.21) 23 (0.21) 42 (0.01) 50 (0.80)	0	101.05	0	0	0	0	0.21	1.81
41	100.00%	0	0	1	0	1	0	0	0	44								
42	100.00%	0.66	0	0.34	0	1	0	0	0	13								
43	150.10%	0	0.27	0.73	0.72	0.28	0	0	0	14 (0.03) 32 (1.00) 41 (0.02)	6.93	0	0	0	0	3.14	1.13	4.01
44	204.07%	0	0	1	0.46	0	0	0	0.54	3 (0.15) 4 (0.20)	2.2	3183.94	0	0	42.64	0.67	4.39	0
45	133.65%	0	0	1	0.75	0.15	0	0	0.1	3 (1.21) 4 (0.13) 41 (0.06)	142.61	1206.05	0	0	0	2.44	5.1	0
46	106.21%	0.6	0	0.4	0	0.92	0.07	0.01	0	8 (0.03) 9 (0.08) 41 (0.07) 42 (0.87)	0	1270.34	0	18.7	0	0	0	0
47	280.21%	0.57	0	0.43	0.25	0.52	0.11	0	0.12	3 (0.12) 4 (0.13) 9 (0.06) 41 (0.06) 42 (0.06) 50 (0.12)	0	9757.11	0	0	0	0	0	0
48	451.48%	1	0	0	0.32	0.23	0	0.44	0	8 (0.13) 50 (0.05) 69 (0.39)	0	740.74	39.84	0	0	0.39	0	0.1
49	133.09%	0.38	0	0.62	0.39	0.6	0	0.01	0	3 (0.35) 8 (0.02) 41 (0.02) 42 (0.58)	0	1004.85	0	0	0	1.06	0	0
50	100.00%	0.71	0	0.29	0.91	0.09	0	0	0	25								
51	289.43%	0	1	0	0.01	0.66	0	0.12	0.21	8 (0.05) 14 (0.04) 32 (0.67) 34 (0.22)	33.25	0	16.09	0	0	2.65	0	0
52	114.15%	0.63	0	0.37	0	0.83	0.16	0.02	0	8 (0.03) 9 (0.03) 20 (0.21) 42 (0.68)	0	613.01	0	6.53	0	0	0	0
53	198.96%	0	0.6	0.4	0.57	0.43	0	0	0	32 (0.16) 41 (0.06) 50 (1.11)	22.59	0	0	0	0	0.47	0.16	0.87

54	121.95%	0	0.28	0.72	0.71	0.29	0	0	0	14 (0.05) 32 (1.03) 41 (0.03)	19.18	0	0	0	0	2.14	1.3	4.13
55	115.64%	0	0.3	0.7	0.75	0.25	0	0	0	32 (0.86) 41 (0.02) 50 (0.19)	34.7	0	0	0	0	2.59	0.86	3.83
56	107.32%	0	0.84	0.16	0.12	0.88	0	0	0	14 (0.25) 32 (0.22) 41 (0.56)	14.09	0	0	0	0	0.83	0.39	0.89
57	106.17%	0.75	0	0.25	0	0.98	0.02	0.01	0	8 (0.03) 9 (0.03) 41 (0.56) 42 (0.41)	0	2255.43	0	17.67	0	0	0	0
58	111.16%	0.03	0.81	0.16	0.13	0.87	0	0	0	14 (0.09) 23 (0.31) 32 (0.23) 41 (0.41)	0	0	0	0	0	0.07	1.02	1.25

Appendix 2- Output oriented CCR-DEA (Continued)

Enterprises	Score	G1 {I}{V}	G2 {I}{V}	G3 {I}{V}	C1 {O}{V}	C2 {O}{V}	C3 {O}{V}	C4 {O}{V}	C5 {O}{V}	Benchmarks	{S} G1 {I}	{S} G2 {I}	{S} G3 {I}	{S} C1 {O}	{S} C2 {O}	{S} C3 {O}	{S} C4 {O}	{S} C5 {O}
59	262.95%	0	0.47	0.53	0.6	0.39	0.01	0	0	9 (0.02) 32 (0.61) 41 (0.04) 50 (0.43)	22.08	0	0	0	0	0	0.61	3.3
60	794.41%	0	0.49	0.51	0.48	0.52	0	0	0	3 (0.32) 5 (0.70) 41 (0.25)	159.51	0	0	0	0	0.97	0.65	2.11
61	165.51%	0	0.36	0.64	0.75	0.25	0	0	0	32 (0.59) 41 (0.02) 50 (0.44)	82.53	0	0	0	0	0.13	0.59	3.26
62	166.78%	0	0	1	0.5	0.48	0.02	0	0	3 (0.33) 9 (0.02) 41 (0.20)	284.92	11664.71	0	0	0	0	0.66	0
63	547.69%	0	0.61	0.39	0.44	0.56	0	0	0	32 (0.61) 41 (0.11) 50 (0.42)	183.8	0	0	0	0	1.83	0.61	3.29
64	367.14%	0.35	0.17	0.48	0.42	0.51	0.08	0	0	3 (0.17) 9 (0.08) 41 (0.02) 42 (0.28) 50 (0.67)	0	0	0	0	0	0	0.34	1.33
65	166.24%	0.04	0.73	0.24	0.18	0.81	0	0	0	9 (0.01) 14 (0.18) 23 (0.54) 32 (0.14) 41 (0.14)	0	0	0	0	0	0	1.58	1.09
66	233.51%	0.44	0	0.56	0.27	0.67	0.06	0	0	3 (0.13) 9 (0.05) 41 (0.01) 42 (0.58)	0	1568.53	0	0	0	0	0.27	0
67	265.74%	0.45	0	0.55	0.69	0.29	0.02	0	0	3 (0.89) 41 (0.03) 42 (0.01) 50 (0.10)	0	505.23	0	0	0	0	1.77	0.19
68	112.18%	0	0.37	0.63	0.75	0.25	0	0	0	32 (0.58) 41 (0.02) 50 (0.48)	22.51	0	0	0	0	1.73	0.58	3.25
69	100.00%	1	0	0	0.21	0.65	0.14	0	0	3								
70	113.21%	0	0.6	0.4	0.32	0.68	0	0	0	14 (0.51) 32 (0.40) 41 (0.13)	41.34	0	0	0	0	3.77	2.97	1.6
71	102.63%	0.57	0	0.43	0	0.97	0.03	0	0	9 (0.03) 41 (0.07) 42 (0.92)	0	1373.52	0	19.67	0	0	0	0
72	120.57%	0.67	0	0.33	0	0.98	0.02	0	0	9 (0.03) 41 (0.27) 42 (0.71)	0	314.94	0	1.17	0	0	0	0
73	224.03%	0.42	0	0.58	0.48	0	0.52	0	0	3 (0.20) 9 (0.03) 20 (0.03)	0	3437.92	0	0	211.85	0	0.39	0

Inputs: G1: number of employees, G2: production capacity, G3: production percentage of total production capacity
Outputs: C1: export percentage of production amount, C2: export amount (tons), C3: percentage of product loss during packaging, C4: percentage of product loss after storage", "C5 percentage of product loss during transportation"

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