Entramado vol. 15, No. 2, julio - diciembre de 2019, p.12-26. (ISSN 1900-3803 / e-ISSN 2539-0279)

Efficiency of midsize enterprises in the free-trade-zone in Barranquilla – Colombia *

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Abstract

In this investigation, the efficiency of midsize companies in the free-trade-zones of Barranquilla was analyzed. For this, a model supported by Data Envelopment Analysis structure (DEA) was proposed which required a rational analysis to define input and output variables in order to measure and test the efficiency of 63 companies under study in 2016 and 2017. The Chamber of Commerce of Barranquilla with which an empirical analysis was performed to measure the efficiency of the sector provided primary information. The research showed that from 2016-2017 the percentage of efficient enterprises improved from 11.11% to 17.46% while 6.34% of companies maintain their efficiency, 42.85% showed improvements and 50. 79% of companies decreased their efficiency.

Keywords
Efficiency, free trade zone, export, Data Envelopment Analysis
JEL classification
M11, F17, F23

Eficiencia de las pequeñas y medianas empresas de la zona franca en Barraquilla- Colombia

Resumen

En esta investigación se analizó la eficiencia de las pequeñas y medianas empresas de la Zona Franca de Barranquilla, para esto se propuso una estructura apoyada en el modelo de Análisis Envolvente de Datos (DEA), lo que requirió un análisis racional para la definición de variables de entrada y salida con el fin de medir y contrastar la eficiencia de 63 empresas objeto de estudio en los año 2016 y 2017,

Recibido: 25/01/2019 **Aceptado:** 2/05/2019

* This research article is the result of a research project entitled: Evaluation of the efficiency of small and medium enterprises in the free zone of the city of Barranquilla-Colombia. And financed by the authors, year 2017.
http://dx.doi.org/10.18041/1900-3803/entramado.2.5476

Cómo citar este artículo: FONTALVO HERERRA, Tomás José; MORELOS GÓMEZ, José y OLIVOS AARÓN, Saúl. Efficiency of midsize enterprises in the free-trade-zone in Barranquilla – Colombia. En: Entramado. Julio - Diciembre, 2019. vol. 15, no. 2, p. 12-26 http://dx.doi.org/10.18041/1900-3803/entramado.2.5476

se partió de la información primaria suministrada por la Cámara de Comercio de Barranquilla con lo cual se realizó un análisis empírico que permitió medir la eficiencia del sector. La investigación mostró que el porcentaje de empresas eficientes mejoró de 11.11% a 17.46%, en los años 2016-2017. Así mismo se observó que un 6.34 % de las empresas mantuvieron su eficiencia, un 42.85 % mostraron mejoras y un 50.79 % de empresas desmejoraron su eficiencia en el periodo 2016-2017.

Palabras clave
Eficiencia, zona franca, exportaciones, Análisis Evolvente de Datos
Clasificación JEL
M11, F17, F23

Eficiência de pequenas e médias empresas na zona franca de Barraquilla - Colombia

Resumo

Nesta pesquisa foi analisada a eficiência das pequenas e médias empresas na Zona de Barranquilla, para isso foi proposta uma estrutura apoiada pelo modelo Data Envelopment Analysis (DEA), que requer uma análise racional para a definição de variáveis de entrada e saída, a fim de medir e contrastar a eficiência de 63 empresas em estudo nos anos 2016 e 2017; isto sob a informação primária fornecida pela Câmara de Comercio de Barranquilla com a qual foi realizada uma análise empírica que permitiu medir a eficiência do setor. A pesquisa mostrou que o percentual de empresas eficientes melhorou de 11,11% para 17,46% nos anos 2016 e 2017. Da mesma forma, observou-se que 6,34% das empresas mantiveram sua eficiência, 42,85% apresentaram melhorias e 50,79% das empresas deterioraram sus eficiência no período 2016-2017.

Palavras-chave
Eficiência, zona franca, exportações, Análise de Envoltória de Dados
Classificações JEL
M11, F17, F23

Introduction

The export sector in the world today is a key segment for the development of global economies and energizing different sectors fighting for leadership of the competitive advantages (Sandeep *et al.,* 2017) of their goods and services. It is precisely this competitiveness, which refers largely to the competitiveness of the enterprise, industry competitiveness or (Charulata and Rajani, 2017) national competitiveness, of the companies in the free trade areas of Barranquilla, which become the focus of this study. The study aims to analyze the behavior of this sector, specifically by analyzing the behavior of financial efficiency of medium - sized exporting companies. For this investigation, the main objective was to analyze their performance and how to improve efficiency in inefficient companies. The following questions to be addressed arise in undertaking this investigation; What should the financial input and outputs variables be that allow measuring the efficiency? How can the financial efficiency of companies in the export sector of the city of Barranquilla be measured? What are the required variable projections associated with the efficiency model of data envelopment analysis DEA CCR-O, so that inefficient companies achieve efficiency?

In this sense, the relevance and importance of applying the statistical model of linear programming DEA for companies in the export sector of the free trade areas of Barranquilla - Colombia, becomes a robust tool for measuring the financial efficiency and the projections that these companies demand to be efficient. Therefore, this investigation provides clear criteria for defining corporate financial variables as to measure the efficiency of export companies under investigation and projections required to achieve efficiency in inefficient enterprises. Recent studies have demonstrated the value of applying DEA model as authors Sharifi and Rezaeian, (2016), Ehsan *et al.* (2015) and Puri, and Prasad (2017) among others highlight. Similarly, the investigation applied in 27 major ports in Brazil for the years from 2007 to 2011, in which several estimates of DEA using the bootstrapping technique were calculated and analyzed, which allowed the bias correction to test differences in levels of efficiency and their main determinants in port areas (Wanke and Pestana, 2016), as well as the study of the assessment of the comparative relationship between efficiency and profitability on the leading Egyptian companies involved in the financial sector, finding that there is a positive link between efficiency and profitability in Egyptian companies. Other research shows that the performance of

various businesses is not optimal, suggesting significant potential for improvements in both profitability and marketability dimensions (Mostafa, 2016).

This article presents the theoretical review and contribution of internationally prominent authors of the Colombian export sector in its structure, highlighting the dynamics and export efficiency of different economic regions of the country, as well as products and their participation in the international market. Next, the methodology allowed from the application of the model DEA - oriented to outputs (CCR-O for its acronym in English) to establish criteria for measuring the efficiency of the 63 firms in the export sector of the free trade areas of Barranquilla-Colombia. In conclusion, the results and analysis of the efficiency variance levels resulting in the study, the group classification considering the degree of efficiency obtained by companies in the sector, the comparative analysis of companies that achieved the efficiency with companies in export sector, and the projections of increase in the net profit to reach the efficiency of the exporting companies that did not reach the efficiency are presented.

1. Reference framework

1.1. Global export dynamic

Efforts to achieve greater competitive advantage of goods and services offered in the international context have led countries to design strategies that allow them to achieve, in the different cluster markets, improved export efficiency, particularly in strengthening international trade activities (Prieger, 2015; Philip and Alappatt, 2015), in the supply chain while minimizing costs in international operations. These authors (Bahmani-Oskooee and Harvey, 2015) highlight the sensitivity to the type of change on trade flows in the industry sector because of the effects in the short and long term of the real depreciation of the dollar on payments not paid of 141 US industries that export to Singapore and 59 US industries that import from Singapore. In this regard, various studies significantly contribute to the analysis of global export dynamics, as developed in the country of Tunisia, in which the competitiveness of Tunisian exports compared with its main competitors through a swap shifts analysis approach was evaluated during the period 1990-2012, showing the importance of the analysis of export performance and the economic contribution that these results mean for development, competitiveness and economic growth of countries (Zayani and Helali, 2017).

Meanwhile, Geldres and Carrasco (2016) evaluated the impact of national programs for export promotion in export official companies in Chile for the period 2002-2011, which could determine the effectiveness of public policy and its contribution on the increased quantitative indicators of export performance available on the official databases of the National Customs Service of Chile. This converges with the export dynamics of the study of 150 exporting Spanish companies that sought to assess the determinants of export culture and in particular the implications of the strategic orientation of export, export commitment, the degree of adaptation of the marketing mix to the international context, the competitive advantage perceived in foreign markets and the efficiency of exports of these companies by the structural equation model through PLS (partial least squares), obtaining as important result the role managers play in strategic export orientation and business success in foreign markets (Navarro *et al.,* 2013).

These strategic export purposes acquired by the countries participating in global trade as a result of corporate and governmental policies (Leão *et al.,* 2016) undoubtedly have contributed to global integration and competitive growth (Garbie, 2017) in the exchange of goods and services that achieve to satisfy at the lowest cost the needs and expectations of communities (Fonseca *et al*., 2016). Studies as developed by Bahng *et al*., (2016) in Hawaii, show the importance of this strategic purpose, from understanding how exporting companies of clothing manufacturers in Hawaii (HAM) were working in globalized circumstances. Identifying the performance of HAM export businesses based on their marketing resources and export barriers allowed to establish important contributions to the clothing manufacturing industry in Hawaii. The study revealed that association or integration into the global market are one of the most important factors that can boost exports. Collaboration (Banerjee, 2016) with reliable international trade agencies turned out to be another key to success in exports.

1.2. Export sector in Colombia

The export sector in Colombia presents a wide variety of products, according to the Ministry of Industry and Commerce. Between 2013 and 2015 the classification of export economic zones had about 25 different products, among which are: coffee, derivatives of oil, textiles, shrimp, footwear, plastics, machinery and equipment and others. This growth has been reflected over the past 20 years, where *"policy and institutional modernization has increased eightfold the countrys exports"* according to ProColombia (2012), a government entity whose main function is to promote non - traditional exports, particularly those of small and medium enterprises (SMEs).

Faced with the possibility to access credit through the Bank for Foreign Trade of Colombia (Bancóldex), SMEs in the

country have had a greater possibility of accessing new markets, such as Austria, Latvia, Italy, Romania, and China, among other countries of Europe and South America. According to the National Business Association of Colombia (ANDI, 2013), in January 2013 Colombian exports were directed mainly to the US (29.3%), China (14.9%), Panama (6.2%), the Netherlands (6.2%), Spain (3.6%), Venezuela (3.3%), Ecuador (2.9%), and Chile (2.9%). This was well aware of the efforts that Colombia expends every day to improve and expand its foreign trade and encourage SMEs to export their products reaching new markets other than national.

1.3. Free trade zones in Colombia

For ProColombia (2017) a "free trade area is a public institution with legal status, administrative autonomy and independent assets, under the Ministry of Foreign Trade, whose purpose is the provision of a public service non-profit to natural or legal persons, natural or foreign, domiciled or not in the country, to introduce within the area goods or raw materials free of charge to manufacture or operate on them and export their products" that seek to promote exports of enterprises in Colombia.

Also, ProColombia (2017) notes that according to the National Administrative Department of Statistics (DANE) there are 97 free trade areas throughout the national territory, in their different classifications, with the Permanent Free Trade Zones (ZFP) the most common. In these areas several, industrial companies of goods and services whose main purpose of promoting products and services reaching the goal to be placed on international destinations, can be installed.

On the other hand, the Bank of the Republic of Colombia (1998) notes that the main Permanent Free Trade Zones in Colombia are located in Barranquilla, Cartagena, Cali and Bogota. Those cities on the Colombian coast had greater participation in exports (FOB values) of the country. So it is important to analyze in this research how efficient they are in managing resources and decision making to improve net income and operating profit of ports under study.

1.4. Efficiency of the export sector in Colombia

DANE reports state that "Total exports of goods from the Colombian free trade zones, recorded a decrease of 4.1% compared with the same month of the previous year." (DANE, 2017). This makes us think about how efficient the businesses are performing, both small and medium enterprises, in managing their resources to achieve its goals, mainly financial ones.

In this sense, it is not only sought that exports grow in nominal numbers, that is, sales in millions of dollars; but it is sought that the profits received by exporting companies are consistent with the resources used, understood as the assets (real estate, furniture and machinery), expenses and costs of the operation demand.

1.5. Data Envelopment Analysis Model DEA CCR-O

In the same vein, Restrepo and Vanegas (2014) show some productivity factors and analyze how they affect efficiency in exporting companies to achieve internationalization, when the DEA model is used.

Similarly, in this investigation the data envelopment analysis model (DEA) was used, which is a quantitative tool that allows data analysis for companies, sectors or decision units (DMU - Decision Making Units) with similar features. The model worked with multiple input and outputs variables, which seek to calculate the financial efficiency under investigation.

With the DEA model oriented to outputs (CCR-O), criteria to measure the efficiency of firms under investigation were established; i.e., companies in the export sector of the Free Trade Zone of Barranquilla, formed by the combination of the inputs and outputs of the companies studied, and the identification of the so - called efficient frontier. All companies that appear on the border will be those that are operating at 100% efficiency for the selected input and output variables. The DEA model determines which companies will constitute a reference for the evaluation, i.e., 100% efficient, which constitutes a pattern to compare those that are not, the companies that are outside of the efficiency frontier will be the inefficient companies, being able to calculate the relative value of this inefficiency; and determine the values they should have or manage to achieve total efficiency levels.

The DEA model CCR-O proposes two models of evaluation of efficiency, an input oriented model (CCR-I) and an output oriented model (CCR-O), the latter seeks to maximize output from resources available. Maximizing efficiency aims at a fractional programming solution which has multiple solutions, in this sense, it is necessary to implement a linear programming model, and this is achieved by leaving the numerator constant (assuming a value of 1) and maximizing the numerator; this procedure is called CCR - output oriented or commonly called CCR -O (Chediak and Valencia, 2008).

The mathematical model used to calculate the efficiency is represented by the following expression:

Basic DEA Model (Model CCR - O)

This model is expressed as follows, if *Yo = (y1o, y2o, y3o..., yso) y Xo* = (*x1o, x2o, x3..., xmo*), representing the inputs and outputs of the DMUo respectively, the measure of efficiency of the unit that is being evaluated can be obtained with the optimal solution of the following model:

$$\text{Max } Z = \frac{\sum_{r=1}^{s} u_{ro}\, y_{ro}}{\sum_{i=1}^{m} u_{ro}\, x_{io}}$$

s. a.:

$$\text{Max } Z = \frac{\sum_{r=1}^{s} u_{rj}\, y_{rj}}{\sum_{i=1}^{m} V_{ij}\, x_{ij}} \leq 1;\ \ j = 1, \dots, n$$

$$u_{rj} \geq 0, \qquad V_{ij} \geq 0$$
$$r = 1, \dots, s \qquad i = 1, \dots, m$$

Being *uro* and *vio* the group of DMU more favorable, the previous model can become:

$$\text{Max } Z = \sum_{r=1}^{s} u_{ro}\, y_{ro}$$

s. a.:

$$\sum_{1}^{m} v_{io}\, x_{io} = 1$$

$$\sum_{r=1}^{s} u_{rj}\, y_{rj} \leq \sum_{i=1}^{m} v_{ij}\, x_{ij} \ ;\ \ (j = 1,2, \dots, n)$$

$$u_{rj} \geq 0, \qquad v_{ij} \geq 0$$

N being the number of DMU and m is the number of input variables and s is the number of output variables.

2. Methodology

For the development of this research, the efficiency from historical information associated with the input and output variables defined for the DEA model proposed for the sector object of this research were analyzed. The research worked with information associated with financial items of 63 small or medium enterprises of the free trade zones of Barranquilla, in 2016 and 2017. The construction of the method was based on a rational analysis to define the input and output variables of the systemic measurement structure DEA focused on optimizing output, in order to determine the efficiencies of the medium enterprises in the Free Trade Zone of Barranquilla in 2016 and 2017. On this scientific work, the essence of the scientific product was obtained applying the DEA method, focused on outputs for organizations under study. This was done with the support of DEA SOLVER PRO Version 13 software. As a criterion of truth, it was based on a combined rational analysis and empirical analysis supported by DEA focused on optimizing variables of Net Operating Income and Operational Income. Likewise method logic started from a rational analysis to determine the input and output variables of the DEA model and articulated with primary historical information for the years 2016 and 2017 taken from the Chamber of Commerce of Barranquilla, which allowed for an empirical analysis.

For the development of this research, financial items for the years 2016 and 2017 of 63 medium companies belonging to the export sector of the Free Trade Zone of Barranquilla were analyzed with the DEA model. For the calculation of efficiencies, input variables such as equity, total assets, total liabilities, net sales, operation expenses and cost of sales were defined, and assigned as output variables Net Utility and Operational Utility which allowed calculating the efficiencies of this business group based on the efficiencies of the two (2) periods.

3. Results

Consequently, the efficiency achieved by the business group for the years 2016 and 2017 was analyzed and the ranking of efficiency of the business group is specifically studied as well as the variation and behavior generated for two (2) years as seen in the respective years.

As can be noted in Table 1, companies Exotika Leather SA, Company Transnaval SAS, Frigorífico Galapa Limitada "FRIGAL", and Hotel Barranquilla Plaza SA were kept from one year to another with efficiencies of 100% which designates them as reference organizations for the measurement of the DEA model used. Similarly, it is commendable to highlight the improvement of companies Interpelli S.A.S., Industrias Sedal S.A., Constructora Rumie S.A.S., Altamoda S.A.S., Arquicentro Del Prado S.A., y Tempro S.A.S, which obtained on average an improvement in efficiency of over 75%, improving its position in the ranking of the companies analyzed.

Of the analysis of variation of efficiencies of the companies under study, it can be seen that four (4) maintained

in excellence, 27 showed improvement and 32 were affected negatively in their performance. This corresponds to 6.34% of companies that maintained their efficiency, 42.857% of companies showed improvements and 50.793% of companies had reductions of their efficiency in the period 2014-2015 which is consistent with historical data associated with the decline in exports by 4.1% presented by DANE (2017).

On the other hand, the companies who suffered reductions of their efficiency, averaging 35% were: Suelos Ingeniería S.A.S., Barbatuscas S.A.S, Oficaribe S.A.S, Golden Cute S.A.S, e Hijos De Enrique Roca S.A.S.; highlighting in particular, Indutrade de Colombia S.A.S., Syver S.A.S., and Ci Metal Trade S.A.S, which having obtained 100% efficiency in 2016, later went on to achieve efficiencies lower than 75%, showing a diminishment in their processes. Unfortunately, it is observable that organizations like Pinillar Limited, and Venter Colombia SAS, are projecting growth rates reflecting as one of the companies that have opportunities for significant improvements in efficiency. A 100% growth in efficiency in the period 2016 to 2017 from organizations like Arquicentro del Prado S.A., Constructora Rumie S.A.S., Altamoda S.A.S., Tempro S.A.S, Boating International Sucursal Colombia S.A., y Galindo Guzmán María Cristina is highlighted.

Table 1.
Variation in the efficiency of companies between 2016 and 2017.

	2016		2017		
Business	**Rank**	**Efficiency Score**	**Rank**	**Efficiency Score**	**Observation**
COMPAÐIA TRANSNAVAL SAS	1	1	1	1	Remained
EXOTIKA LEATHER SA	1	1	1	1	Remained
FRIGORIFICO GALAPA LIMITADA “FRIGAL”	1	1	1	1	Remained
HOTEL BARRANQUILLA PLAZA SA	1	1	1	1	Remained
INTERPELLI SAS	59	0.10819	1	1	Improved
INDUSTRIAS SEDAL SA	56	0,12612	13	0.94530	Improved
CONSTRUCTORA RUMIE SAS	47	0,18464	1	1	Improved
ALTAMODA SAS	46	0,22146	1	1	Improved
ARQUICENTRO DEL PRADO SA	42	0.30350	1	1	Improved
TEMPRO SAS	39	0.33698	1	1	Improved
PROSIGNA SAS	19	0.60130	14	0,94275	Improved
CI COLANDINA COMERCIAL SAS	18	0.67570	15	0.91604	Improved
BOATING INTERNATIONAL SUCURSAL COLOMBIA SA	11	0,77460	1	1	Improved
CALCAREOS SA	21	0,54914	16	0.76995	Improved
SONEN INTERNACIONAL SAS	55	0,14834	37	0.29948	Improved
CLEAN ENERGY COMPRESSION LTDA.	3. 4	0,38756	2. 3	0.53606	Improved
BOLTEN LIMITADA	36	0.35452	25	0.50296	Improved
NOVA MEDICA LTDA	10	0,88418	12	0.99357	Improved
SEDAS DEL CARIBE SAS	37	0.355276	28	0.44190	Improved
EXPOPIELES DEL CARIBE SAS	57	0,11527	fifty	0,19323	Improved
INTERNATIONAL TRADE SA INTERTRADE SA	53	0,15925	44	0,23449	Improved
DITAR SA	48	0,17888	41	0.25012	Improved
FABRICACION Y MONTAJES INDUSTRIALES SA	61	0,05638	55	0,12487	Improved
RODKO LTDA	60	0.10267	53	0,14812	Improved

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	2016		2017		
Business	**Rank**	**Efficiency Score**	**Rank**	**Efficiency Score**	**Observation**
PINILLAR LIMITADA	63	0,02542	62	0,06397	Improved
INVERSIONES TRIFER LIMITADA	51	0,16383	49	0,19902	Improved
PRODUCTS JULIAO SAS	35	0,38582	31	0.41908	Improved
MATERIJO FRATIS SA	50	0,16641	51	0,19183	Improved
GALINDO GUZMAN MARIA CRISTINA	8	0.97804	1	1	Improved
VENTER COLOMBIA SAS	62	0,05580	61	0,06590	Improved
CERAMIA SAS	43	0,29097	38	0,29461	Improved
AEROSUCRE SA	54	0,15275	54	0,12960	Diminished
INDUSTRIA ARTICUEROS SA	30	0.43831	32	0.40553	Diminished
VSI GLOBAL SOLUTIONS SAS SIGLA VSI SAS	58	0.10922	60	0,06721	Diminished
CONSORCIO INDUSTRIAL ALEADOS DEL COBRE SA	49	0,17312	56	0,12290	Diminished
CONSORCIO ABUCHAIBE SAS	45	0,25,992	48	0,20027	Diminished
PELETERIA DEL ORIENTE SA	41	0.32753	39	0.26204	Diminished
CASA SANTANA RON Y LICORES SAS	44	0,28947	47	0.20275	Diminished
IBS ZONA FRANCA SA	14	0.70141	21	0.61331	Diminished
YESOS Y CAOLINES DEL CARIBE SA	2. 3	0,52699	29	0.43888	Diminished
H UJUETA SA	24	0,51690	30	0.42776	Diminished
LATEX DE COLOMBIA SAS SIGLA LATEXCOL SAS	40	0.33506	45	0,23380	Diminished
THERMOCOIL LTDA.	26	0.50005	33	0.39562	Diminished
INSUMEDICAL LTDA.	16	0.68855	22	0,57223	Diminished
INDUSTRIAS THERMOTAR LIMITADA	31	0.43411	36	0.29977	Diminished
ALUTRAFIC LED SAS	12	0.77261	20	0.63581	Diminished
INDUSTRIAS YIDI SA	52	0,16361	63	0,01771	Diminished
CI PRADAZ LTDA.	27	0.46819	35	0.32182	Diminished
LABORATORIOS BEST SA	32	0.41309	43	0,24277	Diminished
INDUSTRIAS LITOGRAFICAS BOSTON SAS LITOBOSTON SAS	33	0.40701	46	0.20956	Diminished
BARRANQUILLA INDUSTRIAL DE CONFECCIONES SA	13	0,71278	26	0.49884	Diminished
SUPERBRIX SA	15	0,69869	27	0.46924	Diminished
INVESTMENTS WE DO LIMITED	38	0.34368	58	0.10971	Diminished
COLARQUIM SAS	9	0.90207	18	0.65903	Diminished
SILICAR LIMITED	22	0,53043	40	0,25940	Diminished
INDUTRADE COLOMBIA SAS	1	1	17	0.72541	Diminished
SUELOS INGENIERIA SAS	17	0.68404	3. 4	0,36336	Diminished
BARBATUSCAS SAS	29	0.45388	57	0,11800	Diminished

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	2016		2017		
Business	**Rank**	**Efficiency Score**	**Rank**	**Efficiency Score**	**Observation**
OFICARIBE SAS	25	0.50160	52	0,15642	Diminished
GOLDEN CUTE SAS	20	0,59196	42	0,24675	Diminished
SYVER SAS	1	1	19	0.64926	Diminished
HIJOS DE ENRIQUE ROCA SAS	28	0.46427	59	0,08363	Diminished
CI METAL TRADE SAS	1	1	24	0,53528	Diminished

Source: Authors

In Tables 2 and 3 the classification of companies according to their degree of efficiency for the years 2016 and 2017 respectively is observed. In 2016, only seven (7) companies achieved efficiency. This represents 11.11% of the companies studied, and they serve as references for other companies. It can also be highlighted that three (3) organizations representing 4.76% of the 63 studied, achieved a high efficiency; whereas those who scored average and low efficiency are 16% and 37% companies respectively, explaining that more than half of the companies on the analyzed sector are not efficient – a worrying situation for a country like Colombia, which made major efforts in public policy in this context of export.

For 2017, we see a substantial improvement in the number of efficient companies, raising the number to 11 representing 17.46% of the total of the companies studied. At the same time, there are four (4) organizations that achieve high efficiency, increasing representation to 6.35% of the 63 studied. It is possible to highlight that there was a change from 84.13% to 76.19% of companies with medium and low efficiency; however, they remain significantly high values, with 10 and 38 companies, respectively.

Table 2.
Classification of companies according to their degree of efficiency, 2016.

Efficient Companies (7)	**High Efficiency Companies (3)**	**Average Efficiency Companies (16)**	**Low Efficiency Companies (37)**
Efficiency = 1	**1 > Efficiency ≥ 0.8**	**0.8 > Efficiency ≥ 0.5**	**0.5 > Efficiency**
SYVER SAS	GALINDO GUZMAN MARIA CRISTINA	BOATING INTERNATIONAL SUCURSAL COLOMBIA SA	CI PRADAZ LTDA.
INDUTRADE COLOMBIA SAS	COLARQUIM SAS	ALUTRAFIC LED SAS	HIJOS DE ENRIQUE ROCA SAS
HOTEL BARRANQUILLA PLAZA SA	NOVA MEDICA LTDA	BARRANQUILLA INDUSTRIAL DE CONFECCIONES SA	BARBATUSCAS SAS
FRIGORIFICO GALAPA LIMITADA "FRIGAL"		IBS ZONA FRANCA SA	INDUSTRIA ARTICUEROS SA
EXOTIKA LEATHER SA		SUPERBRIX SA	INDUSTRIAS THERMOTAR LIMITADA
COMPAÐIA TRANSNAVAL SAS		INSUMEDICAL LTDA.	LABORATORIOS BEST SA
CI METAL TRADE SAS		SUELOS INGENIERIA SAS	INDUSTRIAS LITOGRAFICAS BOSTON SAS LITOBOSTON SAS
		CI COLANDINA COMERCIAL SAS	CLEAN ENERGY COMPRESSION LTDA.
		PROSIGNA SAS	PRODUCTS JULIAO SAS
		GOLDEN CUTE SAS	BOLTEN LIMITADA
		CALCAREOS SA	SEDAS DEL CARIBE SAS
		SILICAR LIMITED	INVESTMENTS WE DO LIMITED

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Efficient Companies (7)	High Efficiency Companies (3)	Average Efficiency Companies (16)	Low Efficiency Companies (37)
Efficiency = 1	1 > Efficiency ≥ 0.8	0.8 > Efficiency ≥ 0.5	0.5 > Efficiency
		YESOS Y CAOLINES DEL CARIBE SA	TEMPRO SAS
		H UJUETA SA	LATEX DE COLOMBIA SAS SIGLA LATEXCOL SAS
		OFICARIBE SAS	PELETERIA DEL ORIENTE SA
		THERMOCOIL LTDA.	ARQUICENTRO DEL PRADO SA
			CERAMIA SAS
			CASA SANTANA RON Y LICORES SAS
			CONSORCIO ABUCHAIBE SAS
			ALTAMODA SAS
			CONSTRUCTORA RUMIE SAS
			DITAR SA
			CONSORCIO INDUSTRIAL ALEADOS DEL COBRE SA
			MATERIJO FRATIS SA
			INVERSIONES TRIFER LIMITADA
			INDUSTRIAS YIDI SA
			INTERNATIONAL TRADE SA INTERTRADE SA
			AEROSUCRE SA
			SONEN INTERNACIONAL SAS
			INDUSTRIAS SEDAL SA
			EXPOPIELES DEL CARIBE SAS
			VSI GLOBAL SOLUTIONS SAS SIGLA VSI SAS
			INTERPELLI SAS
			RODKO LTDA
			FABRICACION Y MONTAJES INDUSTRIALES SA
			VENTER COLOMBIA SAS
			PINILLAR LIMITADA

Source: Authors.

Between 2016 and 2017, only four (4) companies maintained efficiency with 100%. Among which are: Compañía Transnaval S.A.S.; Exotika Leather S.A.; Frigorífico Galapa Limitada "FRIGAL" and el Hotel Barranquilla Plaza S.A. This shows how difficult it is to maintain efficiency levels at 100%, since in the research carried out, a little more than half of the organizations achieved it.

Table 2 and 3 show that the percentage of efficient enterprises improved from 11.11% to 17.46% for an average in the period of 13.95% which is less when contrasted with other studies that analyzed the exporter being from another business group, specifically export companies BASC certified than when other variables such as subtotal, inventory, total current assets, property plant and equipment

suppliers, are analyzed. It was found that of the 32 companies, nine (9) had 100% efficiency. Achieving 28.125% of efficient companies (Fontalvo *et al.,* 2015).

Also, other studies developed by Fontalvo *et al.* (2014) in the export sector, of BASC certified companies of the city of Medellín, show that out of 60 companies evaluated, seven (7) were found to be efficient. That is, 11.66%. Companies under investigation show 14.285% efficient companies, and intermediate results similar to other research. However, in other studies developed by Fontalvo *et al.* (2015) of exporting business groups with better performance as is the case of BASC certified companies in the city of Barranquilla, they are observed with 28.125% efficiency as shown in Table 4.

Table 3.
Classification of companies according to their degree of efficiency (2017).

Efficient Companies (11)	High Efficiency Companies (4)	Average Efficiency Companies (10)	Low Efficiency Companies (38)
Efficiency = 1	1 > Efficiency ≥ 0.8	0.8 > Efficiency ≥ 0.5	0.5 > Efficiency
TEMPRO SAS	NOVA MEDICA LTDA	CALCAREOS SA	BARRANQUILLA INDUSTRIAL DE CONFECCIONES SA
INTERPELLI SAS	INDUSTRIAS SEDAL SA	INDUTRADE COLOMBIA SAS	SUPERBRIX SA
ALTAMODA SAS	PROSIGNA SAS	COLARQUIM SAS	SEDAS DEL CARIBE SAS
HOTEL BARRANQUILLA PLAZA SA	CI COLANDINA COMERCIAL SAS	SYVER SAS	YESOS Y CAOLINES DEL CARIBE SA
ARQUICENTRO DEL PRADO SA		ALUTRAFIC LED SAS	H UJUETA SA
GALINDO GUZMAN MARIA CRISTINA		IBS ZONA FRANCA SA	PRODUCTS JULIAO SAS
FRIGORIFICO GALAPA LIMITADA “FRIGAL”		INSUMEDICAL LTDA.	INDUSTRIA ARTICUEROS SA
BOATING INTERNATIONAL SUCURSAL COLOMBIA SA		CLEAN ENERGY COMPRESSION LTDA.	THERMOCOIL LTDA.
EXOTIKA LEATHER SA		CI METAL TRADE SAS	SUELOS INGENIERIA SAS
CONSTRUCTORA RUMIE SAS		BOLTEN LIMITADA	CI PRADAZ LTDA.
COMPAÐIA TRANSNAVAL SAS			INDUSTRIAS THERMOTAR LIMITADA
			SONEN INTERNACIONAL SAS
			CERAMIA SAS
			PELETERIA DEL ORIENTE SA
			SILICAR LIMITED
			DITAR SA
			GOLDEN CUTE SAS
			LABORATORIOS BEST SA
			INTERNATIONAL TRADE SA INTERTRADE SA
			LATEX DE COLOMBIA SAS SIGLA LATEXCOL SAS

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Efficient Companies (11)	High Efficiency Companies (4)	Average Efficiency Companies (10)	Low Efficiency Companies (38)
Efficiency = 1	1 > Efficiency ≥ 0.8	0.8 > Efficiency ≥ 0.5	0.5 > Efficiency
			BOSTON LITHOGRAPHIC INDUSTRIES SAS SASLITOBOSTON
			CASA SANTANA RON Y LICORES SAS
			CONSORCIO ABUCHAIBE SAS
			INVERSIONES TRIFER LIMITADA
			EXPOPIELES DEL CARIBE SAS
			MATERIJO FRATIS SA
			OFICARIBE SAS
			RODKO LTDA
			AEROSUCRE SA
			FABRICACION Y MONTAJES INDUSTRIALES SA
			CONSORCIO INDUSTRIAL ALEADOS DEL COBRE SA
			BARBATUSCAS SAS
			INVESTMENTS WE DO LIMITED
			HIJOS DE ENRIQUE ROCA SAS
			VSI GLOBAL SOLUTIONS SAS SIGLA VSI SAS
			VENTER COLOMBIA SAS
			PINILLAR LIMITADA
			INDUSTRIAS YIDI SA

Source: Authors.

Table 4.
Comparative table of companies that achieved efficiency with companies in business sectors that export.

Business sector	Medium enterprises in the Free Trade Zone of Barranquilla	BASC certified exporters in Barranquilla	BASC certified exporters in Medellin
% Of efficient companies	14,285%	28,125%	11.67%

Source: Authors.

When performing the analysis of companies not achieving efficiency, shown in Table 5 the projections required companies to reach 100% efficiency in horizons or goals to be achieved to be efficient. In Table 5 are figures or necessary values to achieve net income and operating profit, necessary to achieve the objectives of future efficiency 100%. It constitutes the criterion and projection required by those responsible in making decisions to achieve efficiency in the organizations they lead.

Projections required in Table 5 for improving the business group constitute guidelines associated as responsible in the organizations that must manage and make decisions about the input variables, giving a rational use of resources in order to improve their efficiency, so that they can have optimum performance in efficiency and compete with medium sized companies located in the Free Trade Zone of Barranquilla.

Table 5.
Projected increase in net income to achieve efficiency (2017).

Company	Net profit	Operational utility	Company	Net profit	Operational utility
NOVA MEDICA LTDA	2,484,424,212.99	4,468,643,004.62	SAS CERAMIA	115,971,312.76	5,741,499,472.12
SEDAL INDUSTRIES SA	739,139,923.97	1,985,120,942.53	MAMMALS OF EAST SA	890,753,741.41	2,565,912,365.26
SAS PROSIGNA	203,673,731.37	913,255,216.76	SiliCar LIMITED	1,046,589,463.52	1,201,344,602.96
Indutrade COLOMBIA SAS	1,411,702,283.53	3,094,429,594.11	DIT SA	1,844,496,720.27	5,019,958,410.50
SAS COLARQUIM	1,237,391,051.50	1,458,228,063.89	CUTE GOLDEN SAS	311,796,894.08	861,817,208.56
SAS Syver	770,802,852.80	1,484,109,081.58	BEST LABORATORIES SA	1,182,595,166.95	1,137,996,835.83
SAS LED ALUTRAFIC	806,310,021.26	1,792,319,391.69	INTERNATIONAL TRADE SA INTERTRADE SA	48,785,638.79	2,375,858,470.28
IBS FREE ZONE SA	522,570,969.42	634,653,891.40	LATEX DE COLOMBIA SAS SAS SIGLA LATEXCOL	726,083,646.77	5,100,719,902.28
INSUMEDICAL LTDA.	723,063,727.13	1,259,947,463.97	BOSTON LITHOGRAPHIC INDUSTRIES SAS SAS LITOBOSTON	568,809,469.72	2,060,300,490.89
CLEAN ENERGY COMPRESSION LTDA.	3,215,806,447.68	3,215,806,447.68	HOUSE SANTANA SAS RON AND SPIRITS	2,857,327,272.90	2,166,003,943.57
CI METAL TRADE SAS	824,136,146.53	2,680,838,429.32	SAS CONSORTIUM ABUCHAIBE	2,049,490,056.20	3,568,261,255.94
BOLTEN LIMITED	1,328,029,067.86	2,534,932,674.96	INVESTMENTS LIMITED TRIFER	608,256,397.54	834,584,825.42
BARRANQUILLA INDUSTRIAL DE CONFECCIONES SA	1,348,314,645.24	3,609,654,294.37	CARIBBEAN EXPOPIELES SAS	436,010,080.24	836,995,612.36
CALCAREOS SA	850,164,024.18	1,710,550,595.28	MATERIJO Fratis SA	718,658,599.20	1,399,636,703.62
SuperBrix SA	2,931,979,101.18	3,441,307,922.67	SAS OFICARIBE	1,188,539,540.36	3,483,754,181.60
CARIBBEAN SEDAS SAS	1,052,026,222.01	1,237,677,908.37	Aerosucre SA	2,403,533,540.98	5,605,384,043.18
GYPSUM AND CARIBBEAN CAOLINES SA	765,755,133.12	1,593,831,586.38	INDUSTRIAL SA manufacture and assembly	1,199,804,008.38	1,488,907,872.99
H Ujueta SA	1,520,654,071.14	5,529,846,760.04	COPPER ALLOY INDUSTRIAL CONSORTIUM SA	825,446,545.70	923,088,843.59
COMMERCIAL SAS CI colandina	1,819,303,591.93	1,695,833,000.24	SAS BARBATUSCAS	344,310,794.97	1,077,377,831.27
JULIAO PRODUCTS SAS	693,564,817.91	922,278,809.22	MAKE INVESTMENTS LIMITED	243,549,441.69	521,149,834.25
ARTICUEROS INDUSTRY SA	2,139,429,625.80	4,032,849,589.85	SONS OF ENRIQUE ROCA SAS	495,560,898.43	1,899,639,341.24
THERMOCOIL LTDA.	1,540,309,183.53	2,335,710,957.14	YIDI INDUSTRIES SA	2,495,251,848.98	461,572,395.01
SOIL ENGINEERING SAS	533,269,179.74	1,218,937,414.90	PINILLAR LIMITED	542,573,243.30	3,768,750,325.97

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Company	Net profit	Operational utility	Company	Net profit	Operational utility
CI PRADAZ LTDA.	539,846,209.55	660,271,809.84	Rodko LTDA	284,326,963.22	358,442,165.81
THERMOTAR INDUSTRIES LIMITED	2,516,681,231.34	4,125,468,869.75	COLOMBIA SAS VENTER	16,408,748.05	352,964,835.75
Sonen INTERNATIONAL SAS	2,476,733,406.29	4,040,030,813.14	VSI VSI GLOBAL SOLUTIONS SAS SAS SIGLA	593,062,149.49	643,810,826.92

Source: Authors.

4. Conclusions

On this research, it is important to note that only 4 companies proved to be efficient and 27 showed improvements in the period out of 63 companies evaluated which shows that only 49.2% of companies performed well in the time horizon. This is a challenge for the business group, since companies in the Free Trade Zone are those that energize the economy of a region. Therefore, the projections required for following periods generated in Table 5 are a significant contribution of this research for this business group to make decisions and improve their performance in terms of efficiency.

As a projection of this research in the context of companies from Free Trade Zones of Barranquilla, it would be important to consider other models and references associated with competitiveness, culture, organization, and *management* of knowledge and behavior of financial indicators for different periods of studies analyzed through the multivariate calculation. This is complementary to the analysis and decision making of companies seeking to improve their efficiency as other investigations show, where sectoral or similar groups were analyzed and evaluated (Fontalvo *et al.* 2011; Fontalvo and Morelos, 2012; Fontalvo *et al.*, 2011; Gomez and Fontalvo, 2014; Sickle et al., 2014).

Similarly, it would be important to analyze what factors and variables affect the increased efficiency of other business groups, as seen in Table 4 in the BASC certified companies in Barranquilla. Also, researchers are invited as a projection of this research to review the variables of other reference models for evaluating and structuring systems for companies with export and logistic profiles as those discussed in other investigations. (Fontalvo *et al.,* 2010)

Likewise, as a projection of this research, it would also be important to analyze other factors such as the standardization of norms and organizational culture as an element that affects the efficiency, productivity and competitiveness of business sectors (Morelos, 2016, Morelos *et al.,* 2013 and Mercado *et al.,* 2011). A limitation of this research was the inability to obtain and use financial information for the 63 business group companies for more than the mentioned years, making it impossible to calculate the efficiencies of the business group under investigation for longer periods.

Conflict of interests

The authors have no conflicts of interest to declare.

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