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 Barranquilla - 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.  
https://doi.org/10.18041/1900-3803/entramado.2.5476

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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  
https://doi.org/10.18041/1900-3803/entramado.2.5476
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.

I. 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 (Priefer, 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 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 countries 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 (Bancoldex), 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. (Montoya, et al. 2016)

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 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 \( Y_0 = (y_{1o}, y_{2o}, y_{3o}, ..., y_{so}) \) and \( X_0 = (x_{1o}, x_{2o}, x_{3o}, ..., x_{mo}) \), 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:

\[
\begin{align*}
\text{Max } Z &= \frac{\sum_{r=1}^{s} u_{ro} y_{ro}}{\sum_{i=1}^{m} u_{ro} x_{io}} \\
\text{s. a.:} & \\
\text{Max } Z &= \frac{\sum_{j=1}^{n} u_{rj} y_{rj}}{\sum_{i=1}^{m} v_{ij} x_{ij}} \leq 1; \ j = 1, ..., n \\
u_{rj} \geq 0, \quad v_{ij} \geq 0 & \\
r = 1, ..., s \quad i = 1, ..., m
\end{align*}
\]

Being \( u_{ro} \) and \( v_{io} \) the group of DMU more favorable, the previous model can become:

\[
\begin{align*}
\text{Max } Z &= \sum_{r=1}^{i} u_{ro} y_{ro} \\
\text{s. a.:} & \\
\sum_{i=1}^{m} v_{io} x_{io} &= 1 \\
\sum_{r=1}^{s} u_{rj} y_{rj} &\leq \sum_{i=1}^{m} v_{ij} x_{ij}; \ (j = 1,2, ..., n) \\
u_{rj} \geq 0, \quad v_{ij} \geq 0 &
\end{align*}
\]

\( N \) 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, Frigorifico 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.

| Business                                  | 2016 Rank | Efficiency Score | 2017 Rank | Efficiency Score | Observation   |
|-------------------------------------------|-----------|------------------|-----------|------------------|---------------|
| COMPADIA 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                    | 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      |

Continued on the next page
| Business                                      | 2016 Rank | 2016 Efficiency Score | 2017 Rank | 2017 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        |
| MATERIO 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        | 0.35506               | 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      |
| INUTRADE 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      |

Continued on the next page
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.

| Business                          | 2016 Rank | Efficiency Score | 2017 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
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.

| 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 | H UJUETA SA | OFICARIBE SAS | THERMOCOIL LTDA. |
| TEMPRO SAS | LATEX DE COLOMBIA SAS SIGLA LATEXCOL SAS | PELETERIA DEL ORIENTE SA | 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 | MATERUJO FRATIS SA |
| INVERSIONES TRIFER LIMITADA | INDUSTRIAS YIDI SA | INTERNATIONAL TRADE SA | AEROSUCRE 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 |
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 Medellin, 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.

| 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  | ALUTRIFIC 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.                |
| COMPAIDAD 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 |

Continued on the next page
| 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 |
| EXPOLIELES 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                    | 2,484,422,212.99 | 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 INTERTRADE SA    | 48,785,638.79  | 2,375,858,470.28    |
| IBS FREE ZONE SA                   | 522,570,969.42  | 634,653,892.14       | 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 SAS  | 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    |
| JUIIAO 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    |

Continued on the next page
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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\begin{array}{|c|c|c|c|c|c|}
\hline
\text{Company} & \text{Net profit} & \text{Operational utility} & \text{Company} & \text{Net profit} & \text{Operational utility} \\
\hline
\text{CI PRADAZ LTDA.} & 539,846,209.55 & 660,271,809.84 & \text{Rodko LTDA} & 284,326,963.22 & 358,442,165.81 \\
\text{THERMOTAR INDUSTRIES LIMITED} & 2,516,681,231.34 & 4,125,468,869.75 & \text{COLOMBIA SAS VENTER} & 16,408,748.05 & 352,964,835.75 \\
\text{Sonel INTERNATIONAL SAS} & 2,476,733,406.29 & 4,040,030,813.14 & \text{VSI VSI GLOBAL SOLUTIONS SAS} & 593,062,149.49 & 643,810,826.92 \\
\hline
\end{array}
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