Abstract

A study of the association between business competitiveness and endogenous factors was carried out: quality assurance and information systems in plastics recycling companies in the Colombian Caribbean region in 2016. The population studied was 158 companies that recycle waste from plastics of the Colombian Caribbean coast. The instrument for gathering information was the IDB’s Competitiveness Map. The project was carried out in three (3) phases: In the first two phases, endogenous factors (quality assurance and information systems) were evaluated through a survey in each of the participating companies (micro and small enterprises). In the third, the endogenous independent variables were crossed with the dependent one (business competitiveness) by constructing the bar diagrams of the relationship analysis. The results showed statistical significance at a level of confidence of 95% between business competitiveness and endogenous factors quality assurance and information systems.

Keywords: Recycling, plastics, competitiveness, significance, statistics
Introduction

Nations compete in international markets based on the competitive capacity of their companies (large, medium or small). For this reason, international organizations such as the IDB (Inter-American Development Bank), the European Union, the OECD (Organization for Economic Cooperation and Development) and the World Bank have continuously formulated development programs that promote the strategic competitiveness of companies and specifically SAMB in the new century [1]. These organizations have agreed to support these nations with new economic development programs that allow them to advance in their regions and to position them in a specific sector of the economy.

Porter (1990) [2] and Krugman (1994) [3] consider that economic competition does not occur between nations, but between companies with competitive capacity. From this perspective, nations legislate public policies in which the delivery of benefits to the business sector is consecrated so that they increase their competitiveness and productive capacity. For this, they provide tax incentives for generating employment, for donations, for hiring personnel with disabilities, among others. For these reasons, business competitiveness there are those who consider that it derives from the competitive advantage that companies develop through their organizational methods and production, in contrast to those of the competition in the specific market in which they operate, where the price and quality of the final product are fundamental [4]. The possibility that a company (large, medium or small) achieves and maintains competitiveness levels is associated with elements of competitive advantages and with own endogenous and exogenous factors of the industrial sector to which they belong as well as the region-country in which it is located [5].

In the Colombian Caribbean region, there are a lot of different types of companies, but in recent years, solid waste recycling companies, specifically plastics, have become very important, especially because of the large amount of waste that is generated and that has allowed them to grow in a sustained manner. In this sense, the recycling rate of solid waste specifically of plastics is low. In Colombia, in 2016, the Ministry of Environment and Sustainable Development (MESD) estimated the recycling rate by 17%, proposing a goal of 20% by 20187 [6]. This indicates government support for this type of productive activities of re-processing of plastics waste. In this order of ideas, the present investigation studied the degree of statistical association between business competitiveness and some endogenous factors considered relevant by the competitiveness map of the Inter-American Development Bank (IADB) [7]. The study focused on the plastic waste recycling companies located on the Colombian Caribbean coast, specifically in the departments of La Guajira (26 in total), Atlántico, Magdalena and Bolívar (32).

One of the endogenous factors of business management is the quality assurance, which is related to the implementation of quality management systems, certifications, risk management systems, programs to deal with contingencies,
among others. In this sense, the evidence indicates that companies with high levels of competitiveness are those where products and processes are certified by some national or international standard [8, 9]. In the same way, it is considered a process of quality assurance, those operational activities aimed at offering a product free of defects and that meets the requirements and needs of final consumers (customers) [10, 11, 12, 13].

Another factor considered endogenous is the information system implemented in companies, since there is evidence that new information and communication technologies (ICT) constitute a mechanism of competitiveness in the new millennium [8, 9, 14, 15, 16]. In addition, they must have qualified and trained human resources in these new technologies, as well as having levels of systematization of information according to their production processes and be able to implement contingency plans in flexibly, dynamic and in short time. This makes them become more competitive companies both nationally and internationally [17, 18, 19, 20, 21].

**Materials and Methods:** Population and sample size: The population participating in the study were 158 companies that recycle plastic waste from the Colombian Caribbean coast, specifically from the departments of La Guajira, Atlántico, Magdalena and Bolívar. The sample was 58 companies distributed as indicated in Table 1.

<table>
<thead>
<tr>
<th>Departamento</th>
<th>Pequeña empresa Small company</th>
<th>Microempresa Microenterprise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guajira</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>Magdalena</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Atlántico</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Bolívar</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>41</td>
<td>17</td>
</tr>
</tbody>
</table>

Percentage of companies participating in the study 70.7% 29.3%

Note: Classification according to Zevallos 2003 [17].

The number of direct jobs generated by the micro-enterprises that recycle plastic waste were in the range of 0 to 10 (0< Number of jobs≤10) while for the Small Companies they were between 10 and up to 50 jobs (10< Number of jobs≤50). The companies are older than 5 years. To estimate the size of the sample when it comes to a finite population of less than 100,000 individuals is calculated according to Fong et al. (2017) [22] by equation (1):

\[
n = \frac{\sigma^2 Npq}{e^2(N - 1) + \sigma^2 pq}
\] (1)
Where:  
- $n$: Number of elements that the sample must have;  
- $\sigma$: Level of confidence or risk chosen (95%);  
- $p$: Probability that an element is selected (50%);  
- $q$: Probability that an element is not selected ($q = p$);  
- $e$: Error allowed (5%);  
- $N$: Number of population elements.

**Variables, phases and reliability of the test**

The variables used in the research were classified into two (2) categories (independent and dependent):  
\begin{itemize}
  \item[a.] Endogenous independent variable: Quality assurance, information systems.
  \item[b.] Dependent variable: Business competitiveness
\end{itemize}

The endogenous factors were evaluated in 2016, through the instrument designed by the IDB and known as the IDB’s Competitiveness Map [7] which consists of sixty-four (64) questions which were modified and adapted to the case Colombian Caribbean region [7, 11, 17, 19-21]. This instrument evaluates the dimensions: strategic planning (6 questions), production and operations (13 questions), quality assurance (6 questions), marketing (12 questions), accounting and finance (7 questions), human resources (8 questions), environmental management (5 questions) and information systems (7 questions).

For the present investigation, only the endogenous factors were measured: quality assurance and information systems. Business competitiveness was evaluated according to the following factors: Competitive situation of the company with respect to the business sector of recycling of plastic waste (12 questions), use of competitive strategies (12 questions) and innovation and business improvement (12 questions) in accordance with Ibarra et al. [16] and the IDB competitiveness map [7, 21]. In both cases, the instrument was structured according to the Likert scale. Each dimension was assessed on a scale of 0 to 100 points with the following interpretation: Low: 0-60 points and High: 61-100. Two instruments (2) were applied for each of the companies classified in Table 1. The first one, for the Micro-enterprises of recycling of plastic waste and the second, for the Small Company of recycling of plastic waste.

The research was carried out in three (3) phases: In the first, the endogenous factors (quality assurance and information systems) were evaluated through the IDB’s Competitiveness Map (survey) to each of the companies participating in the study according to the classification established in Table 1. In the second, the level of business competitiveness of each of the participating companies was assessed through the IDB’s Competitiveness Map. In the third, the statistical analysis was made and the independent endogenous variables were crossed with the dependent one (business competitiveness), constructing the bar diagrams of the relational analysis.

The instrument was validated for its application in Latin America by the IDB [7]. The internal consistency of the test was determined by Cronbach’s Alpha [23], which gave a value of 0.88 which is considered as high reliability.

The dependent variable Business competitiveness was classified into two categories:  
\begin{itemize}
  \item[LBC]: Low Business competitiveness (scores below 60 points (LBC <60))
  \item[HBC]: High Business competitiveness (scores equal or greater than 60 (HBC ≥ 60))
\end{itemize}
The endogenous independent variable were classified into two categories: a) Low Quality assurance (LQA) (LQA <60 points) and high Quality assurance (HQA) (HQA ≥ 60) b) Information Systems: Low information systems (LIS) (LIS <60 points) and High Information Systems (HIS) (HIS ≥ 60).

Statistic analysis: Initially, business competitiveness was measured using the "IDB Competitiveness Map" instrument [7], which was classified into two (2) categories: Low (0-60 points) and high (61-100 points). Subsequently, the number of cases in low and high category for each of the variables object of the present study was determined to construct the bar diagrams of the relational analysis. Next, the Chi-Square test is evaluated between business competitiveness and endogenous independent variables, determining their degree of statistical association.

Results and Discussion

According to equation 1, with a confidence level of 95%, a sample size of 58 business is obtained. The instruments were applied for each of the companies classified in Table 1. Small companies (70.7%) and Microenterprise (29.3%). The Chi-Square test was evaluated to analyze the relationship between business competitiveness and independent endogenous variables (Quality assurance, Information Systems).

Business competitiveness yielded the following results: For Microenterprises: Competitive situation (50%), use of competitive strategies (25%) and innovation and business improvement (25%). For Small Businesses: Competitive situation (60%), use of competitive strategies (20%) and innovation and business improvement (20%). These results indicate that the small company is in a more advantageous situation than the Microenterprise in terms of competitive situation, while the use of strategies and innovation and improvement are quite similar, that is, values between 20% and 25%. All this indicates that the Micro-companies are competing very closely with the Small Company, verifying with this the postulates of Porter (1990) [2] and Krugman (1994)[3]. In the same way it can be said that in this waste recycling sector of plastic products, the competitive advantage that should be much greater in the Small Business is not. This is very likely due to the fact that the Microenterprise is in a dynamic of marketing and implementation of quality processes and information systems in accordance with the certification of processes and products according proposed by Abdel et al. [4].

Table 1 indicates the values of p (statistical significance) where it is observed that there is a relationship of high statistical significance between business competitiveness and quality assurance and information systems of plastic waste recycling companies (p<0.05). This means that the systems of quality assurance and information systems and business competitiveness correspond with statistical significance , that is to say, it is more probable that a company that recycles plastic waste with quality assurance systems adjusted to national or international standards and with updated information systems and with state-of-the-art technologies is a
company with high business competitiveness in the markets checking the postulates of Cabrera et al. [5], Aragón et al. [8], Flores et al. [9], Martínez et al. [10], and Martínez and Álvarez [19].

Table 1 Chi-Square Test for Business Competitiveness

<table>
<thead>
<tr>
<th>Variable</th>
<th>Chi Square</th>
<th>GL</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality assurance</td>
<td>8.11</td>
<td>1</td>
<td>0.004**</td>
</tr>
<tr>
<td>Information Systems</td>
<td>7.52</td>
<td>1</td>
<td>0.006**</td>
</tr>
</tbody>
</table>

** Relationship with high statistical significance at a confidence level of 95%

Figure 1 shows the relationship bar diagram between the endogenous variable quality assurance and business competitiveness for the Micro and Small Companies studied. It is observed that there is correspondence in the results, that is, both for the Micro and the Small Business a high level of quality assurance (44% for the Small business and 47% for the microenterprise) corresponds to high levels of competitiveness. This occurs in almost half of the companies surveyed, meaning that quality management systems, certifications (products and processes), finished products, risk management systems and programs to deal with contingencies under national or international standards have a positive impact in the business competitiveness of this type of plastic recycling companies being able to verify the approaches of Aragón et al. [8], Flores and González [9], Martínez et al. [10] and Martínez and Álvarez [19].

Figure 1. Joint behavior between Quality Assurance and Business Competitiveness

In a similar way it is observed that both for Micro and Small Business, low levels of quality assurance correspond to low levels of business competitiveness (27% for the Small business and 35% for the microenterprise), additionally checking the
statistical significance between variables. In addition, the low levels of business competitiveness may be due to the fact that the quality assurance processes do not conform to any national or international regulations or are in the process of implementing the quality assurance system, which slows the pace of production while advancing the respective adjustments of finished product quality. There are also recycling companies that, despite having high levels of business competitiveness, have low quality assurance systems (10% for small businesses and 6% for microenterprises). This may be due to administrative planning problems or that some of these companies monopolize part of the market due to the high production capacity they have neglecting quality management systems.

In addition, it is likely that the success that they have maintained with a certain product in the market have made them neglect important aspects such as quality assurance that they surely have not given the importance it requires. On the other hand it is observed that there are companies that despite having high levels of quality assurance have a low business competitiveness (19% for the small company and 12% for the microenterprise). This can be explained because some of the companies were in processes of technological updating and implementation of quality assurance systems, aspects that directly affect their business competitiveness. However, it is important to note that one of the strategies that are implementing this type of company to improve levels of business competitiveness is the associativity [24] with which they intend to cover a large part of the market and at the same time, improve group levels of business competitiveness.

Figure 2 shows the relational bar diagram between the endogenous variable information systems and business competitiveness for the Micro and Small companies studied. It is observed that there is correspondence in the results, that is, both for the Micro and for the Small Company a high level of information systems (32% for the Small business and 47% for the microenterprise) corresponds to high levels of business competitiveness. This is present in almost half of the microenterprises and in the third part of the small companies surveyed, meaning also that the information systems related to the new technologies of reprocessing of plastic waste, levels of systematization of information according to the production processes and be able to implement contingency plans in an agile, dynamic and short time. This constitutes a technological tool that has a direct impact on the strategic plan of these companies, evidencing the high business competitiveness that they possess. verifying the approaches of Aragón et al. [8], Flórez and González [9], Aragón and Rubio [13], Cuevas et al. [14], Estrada et al. [15], Ibarra et al. [16] and Zevallos [17].

In a similar way it is observed that both for Micro and Small Business, low levels of information systems correspond to low levels of business competitiveness (39% for Small Business and 41% for Microenterprise), also checking the statistical significance between the variables. In addition, the low levels of business competitiveness may be due to the fact that the few information systems that this group of companies possess do not allow them to adjust to the requirements of the final consumers, either because of poor communication or due to the exchange of
technical information and commercial. It is also observed that despite having high levels of business competitiveness, they have low information systems implemented in companies (7% for Small Businesses and 6% for Small Businesses). This may be because they are companies with recognition in the market and because they are positioned, their levels of business competitiveness have remained high despite having low information systems implemented. In addition, for the time of permanence in the market they have large strategic programs to approach the market neglecting the new internal technologies of the company.

![Contingency Chart](image)

Figure 2. Joint behavior between Information Systems and Business Competitiveness.

On the other hand it is observed that there are companies that despite having high levels of information systems present a low business competitiveness (22% for the Small business and 6% for the microenterprise). This can be explained because some of the companies, despite having state-of-the-art technologies for the reprocessing of plastic waste and with robust equipment in terms of new technologies for the administrative area, are in the process of training and transferring technology, that is to say, they are in a phase of adoption and adaptation to new technologies. They are also companies in the process of consolidation in the market with new products that are barely being made known to final consumers.

**Conclusion**

Based on the analysis as above, it is concluded as follow: There is a statistically significant relationship at a 95% confidence level, between Business Competitiveness and the endogenous quality assurance factor. This means
that quality plans and programs, certifications (products and processes), finished products, risk management systems and programs to deal with contingencies are adjusted to the criteria demanded by current regulations, directly impacting in the competitiveness of companies plastics recyclers of the region. That is, an endogenously organized company with well-defined quality assurance plans is very likely to be a company with high levels of business competitiveness. There is a statistically significant relationship at a 95% confidence level, between Business Competitiveness and the endogenous Information Systems factor. This means that the information systems that employ this type of recycling companies related to the new technologies for the reprocessing of plastic waste and administrative information systems used in the commercialization, quality assurance and environmental management processes have a direct impact on the strategic plan of these companies. That is to say, that a plastic waste recycling company with a robust information system is very likely to be or become a company with high competitiveness in the sector.

References


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