

# Application Of Business Intelligence Techniques For The Characterization Of Enterprises In The Dominican Republic

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## ABSTRACT

The Dominican Republic has more than 1,200,000 Micro, Small and Medium Enterprises (MSMEs) in different Economic Sectors. Although the State recognizes the value that these have for the economic development of the country, there is no systematized and automated characterization that allows for an analysis that helps decision-making. This article shows the results when applying Business Intelligence Techniques for the characterization of Enterprises, considering the Systematization of Information through a web application. In this sense, 179 Micro, Small and Medium-sized Enterprises were analyzed, using an instrument that allowed knowing different variables associated with the economic development of each of the Enterprises. Results show the incidence of different factors in the generation of income for the Enterprise.

**Keywords:** Business Intelligence, Enterprises, Economic Sectors

## 1. INTRODUCTION

The MSMEs Centers in the Dominican Republic are based on the Small Business Development Center (SBDC) model of the United States [1], which are Business Centers that provide advice, training, links and technical and administrative assistance to the Micro and Small Enterprises in the United States. The mission of an SBDC Center is to promote the Growth, Innovation, Productivity and Profits of Small Enterprises, through improvements in Business Administration, as well as the improvement of institutional coordination in the design and execution of services for Development Integral Enterprises, in favor of the MSMEs and Entrepreneurs of the country.

In the Dominican Republic, Enterprises are classified as MSMEs, if they meet the following conditions:

- Micro Enterprise: 1 to 10 workers, gross annual sales up to US \$ 144,000 approx.
- Small Enterprise: 11 to 50 workers, gross annual sales up to US \$ 1,000,000 approx.

- Medium Enterprise: 51 to 150 workers, gross annual sales up to US \$ 3,700,000 approx.

When carrying out a search about the characterization of the Enterprises in the Dominican Republic, in different Web Platforms, a lack of sources of Statistical Information and research that allowed determining the characteristics of the Enterprises in the country was detected. Due to the above, it could be inferred that the Dominican population does not know the real situation of MSMEs, how they work, the income they generate, what technologies they use, how they communicate with their clients, what number of Employees they have, what training these Employees have, how they control their income and expenses, what cost system they have. To answer these questions, an Information System was developed to allow the acquisition of reliable Information, considering the quality of the data, in such a way that the use of Business Intelligence Techniques for Information Analysis was possible. The results allow different variables to be identified, including the impact on the competitiveness of MSMEs.

Current Enterprises dynamics require that Enterprises be agile, customer-oriented, efficient and data-based to be relevant in the Digital Economy. The Digital Economy is different, in many respects, from the Classical Economy. In the Digital Economy, Enterprises must observe and consider many more dynamics to understand the nature of events that may hinder the growth of Enterprises. Difficulties can come at any time and from anywhere in the Digital Economy. Characterizing and anticipating the difficulties of the Digital Economy and the changing market conditions is a great challenge for the Corporations, being important that the Corporations themselves understand the relevant dynamics and their characterization in a holistic way [2].

Currently, for a Enterprise to evolve and last, it must dedicate an important part of its time and its economic and human resources to the collection, process, application and projection of Information. For this reason, Information plays a decisive role in the Enterprise and becomes its main asset. It must be clear, precise and adapted to the training and profile of the people to whom it is addressed. It must be fast and available when needed, and in a complete and harmonized way with other Information [3]. The organizations must make use of the Information for the development of their daily activities and, in this way, have a high level of competitiveness and development possibilities.

### **1.1. Business Intelligence Techniques**

The concept of Business Intelligence (BI) was introduced in 1989 by analyst Howard Dresner of the Gardner Group [4]. The root of this concept is found in the 70s in the mainframe reporting systems, when the relationships were static, two-dimensional and without analytical facilities, and it was desired to have systems with dynamic, multidimensional reports, with support for predictive decisions, which determined the development of BI. Business Intelligence is the set of methodologies, applications and technologies that allow gathering, debugging and transforming data from transactional systems and Unstructured Information into Structured Information, for its direct exploitation or for its analysis and conversion into Knowledge, thus supporting the taking of decisions about the Enterprises [5].

The Business Intelligence Techniques allow analyzing the Information obtained through a virtual platform (Information System) on the Enterprises Dynamics of Enterprises in the Dominican Republic. Additionally, it facilitates the generation of reports and reports where variable crossings are found, to generate greater knowledge about the most relevant characteristics that allow increasing the economic development of the country.

Data processing in Business Intelligence is a fundamental part of the process. For this, a virtual application was developed that included an Information System, where the Information of each of the Enterprises is stored [6]. The software and, in general, the Business Intelligence tools are based on the use of complex Information Systems that use data

extracted from three different sources: Production Systems; Information related to the Enterprise or its scopes, both within and outside the organization; and Economic Data. Regardless of their origin, the data is subjected to three different processes, with the aim of profiling and homogenizing them, so that they can fulfill their role as generators of quality information, useful and effective for decision-making [7]:

- Extraction Process
- Transformation process
- Loading Process or ETL Process

The main characteristics that the data must have are, among others: Accuracy, Reliability, Consistency, Relevance and Precision. However, the most important are the objectives to be achieved and their correct analysis.

## 2. PROPOSAL

The Storage of Information for a diagnosis of MSMEs, which are attended at the UAPA MSME Center in Santo Domingo Este, becomes a fundamental step in the characterization of MSMEs. The characterization process, through Enterprises Intelligence, was developed in 3 steps. In the First Phase, research was carried out on the state of the art on conducting Enterprise's characterizations, as well as on methodologies, and the instruments for the Collection of Information were constructed. Subsequently, in the Second Phase, the Information System was developed, and information entry campaigns were carried out in the System, considering the quality of the data. Finally, in the Third Phase, the data acquired was entered into Business Intelligence software (Microsoft's Power BI®). In this phase, the Information was processed, complying with the extraction, transformation and loading stages, which allowed generating results with the most important variables. Figure 1 shows the methodology used.



**Figure 1.** Phases of the methodology used

When applying the methodology, a database with 38 variables was developed to have information on MSMEs that included: Owner's sex, Economic sector to which he belongs, formal or informal, Enterprises classification (Micro, Small or Medium-sized Enterprise), group associative, number of employees by sex, whether they keep accounts, annual income, their market, social media management, e-mail and mobile telephony, among other topics.

Here are some initial values considered:

- MSMEs. We worked with 179 MSMEs from the Dominican Republic that were attended by the UAPA MSMEs Center in Santo Domingo Este.
- Geographical space. The Eastern Zone of the City of Santo Domingo, National District, Dominican Republic was taken as the geographic space for this Research.
- Temporary delimitation. The research was carried out with information collected by the actions of the UAPA MSMEs Center, Santo Domingo Este, in 2019.

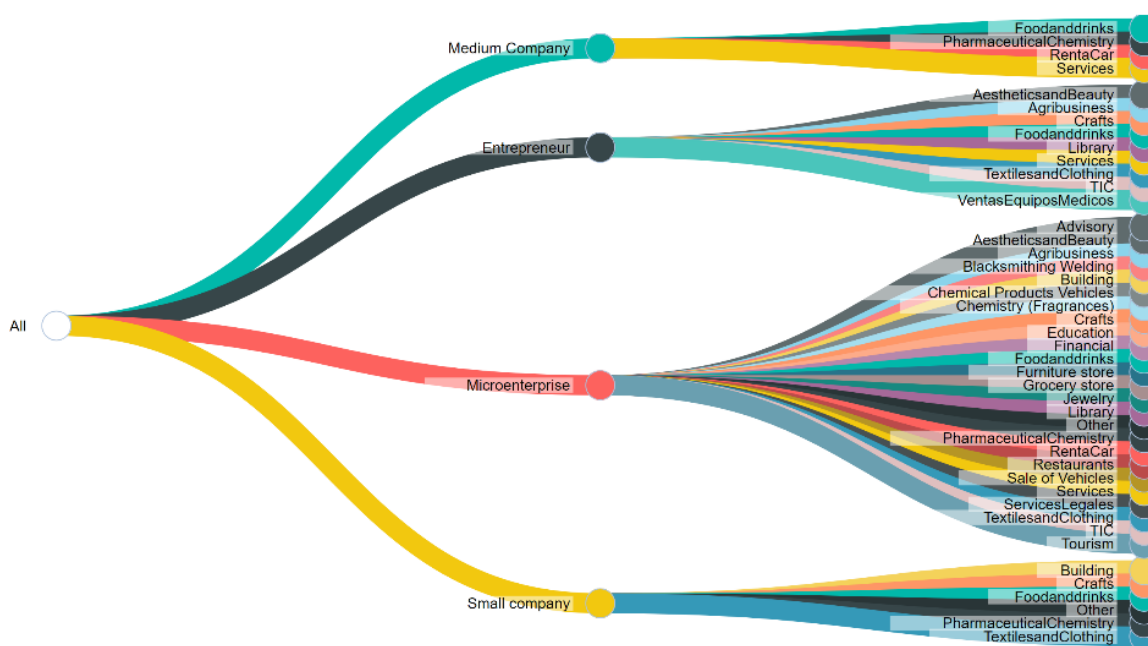
## 3. EXPERIMENT AND RESULTS

In the characterization of the 179 MSMEs attended by the UAPA Santo Domingo MSME Center, all provided complete information. Regarding the sex owned by the Enterprises, it was found that 53.6% belong to the female sex and 46.4% to the male sex. The data in Table 1 allows us to determine that the MSMEs served are carried out in different Sectors. 18.4% belongs to the Aesthetics and Beauty Sector; 14.5%, to the Food and Beverage Sector; 8.9%

to Services; 8.4% to the Textiles and Clothing Sector; 6.7% to ICT; 5% to Pharmaceutical Chemistry; 4.5%, to Construction; 3.4%, to the Agro industrial Sector; and the remaining percentage is distributed among other Sectors as shown in figure 2, where the Enterprises Classification by Type and Sector generated by BI software is observed.

**Table 1.** Sector to which the Enterprises belong

| ECONOMIC SECTOR            | Frequency | %    | % Valid    | % Cumulative |
|----------------------------|-----------|------|------------|--------------|
| Aesthetics and Beauty      | 33        | 18,4 | 18,4       | 20,7         |
| Food and Drinks            | 26        | 14,5 | 14,5       | 50,8         |
| Other                      | 19        | 10,6 | 10,6       | 64,8         |
| Services                   | 16        | 8,9  | 8,9        | 82,7         |
| Textiles and Clothing      | 15        | 8,4  | 8,4        | 91,6         |
| TIC                        | 12        | 6,7  | 6,7        | 98,3         |
| Pharmaceutical Chemistry   | 9         | 5    | 5          | 69,8         |
| Building                   | 8         | 4,5  | 4,5        | 29,1         |
| Crafts                     | 7         | 3,9  | 3,9        | 34,6         |
| Agri Enterprises           | 6         | 3,4  | 3,4        | 24           |
| Advisory                   | 4         | 2,2  | 2,2        | 2,2          |
| Restaurants                | 3         | 1,7  | 1,7        | 72,6         |
| Chemistry (Fragrances)     | 2         | 1,1  | 1,1        | 30,7         |
| Education                  | 2         | 1,1  | 1,1        | 35,8         |
| Furniture Store            | 2         | 1,1  | 1,1        | 52           |
| Library                    | 2         | 1,1  | 1,1        | 54,2         |
| Renta Car                  | 2         | 1,1  | 1,1        | 70,9         |
| Vehicle Sale               | 2         | 1,1  | 1,1        | 73,7         |
| Tourism                    | 2         | 1,1  | 1,1        | 99,4         |
| Blacksmithing Welding      | 1         | 0,6  | 0,6        | 24,6         |
| Chemical Products Vehicles | 1         | 0,6  | 0,6        | 29,6         |
| Financial                  | 1         | 0,6  | 0,6        | 36,3         |
| Grocery Store              | 1         | 0,6  | 0,6        | 52,5         |
| Jewelry                    | 1         | 0,6  | 0,6        | 53,1         |
| Legal Services             | 1         | 0,6  | 0,6        | 83,2         |
| Medical Equipment Sales    | 1         | 0,6  | 0,6        | 100          |
| <b>Total</b>               |           |      | <b>179</b> |              |



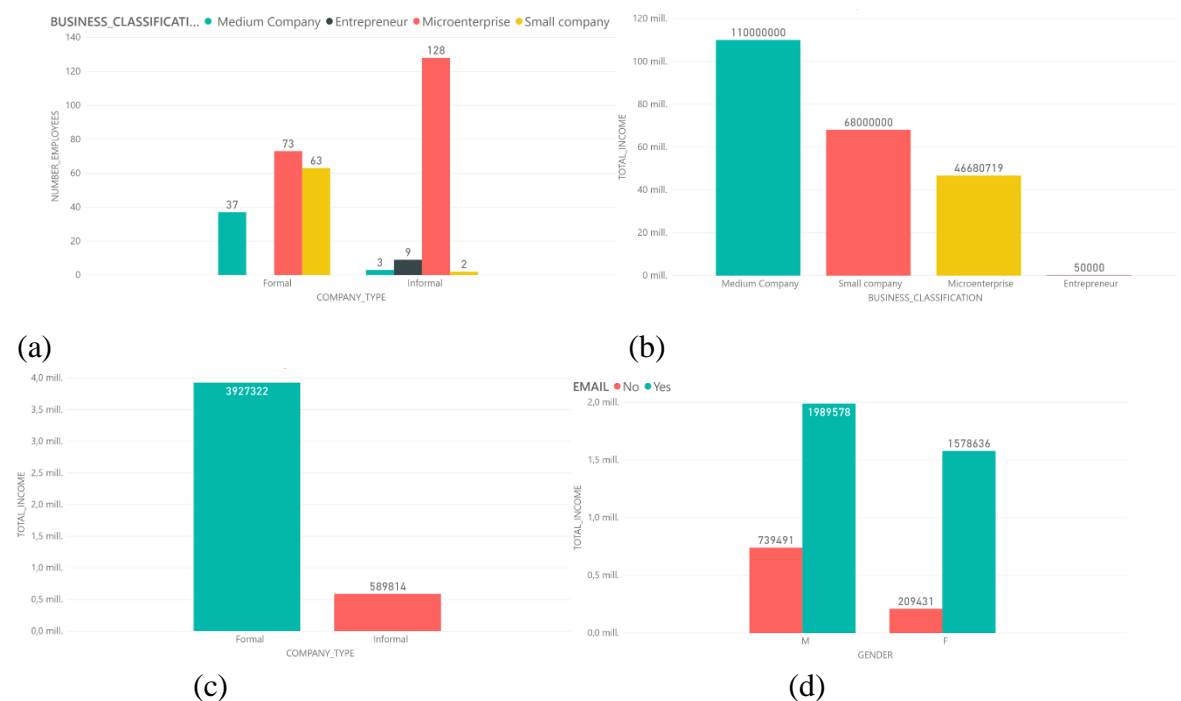
**Figure 2.** Classification of Enterprises by Type and Sector

Table 2 shows the number of Employees, finding that 40% of the Enterprises have between 1 and 7 Employees. The remaining percentage is distributed in Enterprises that have more than 7 Employees.

**Table 2.** Number of Employees by Enterprise

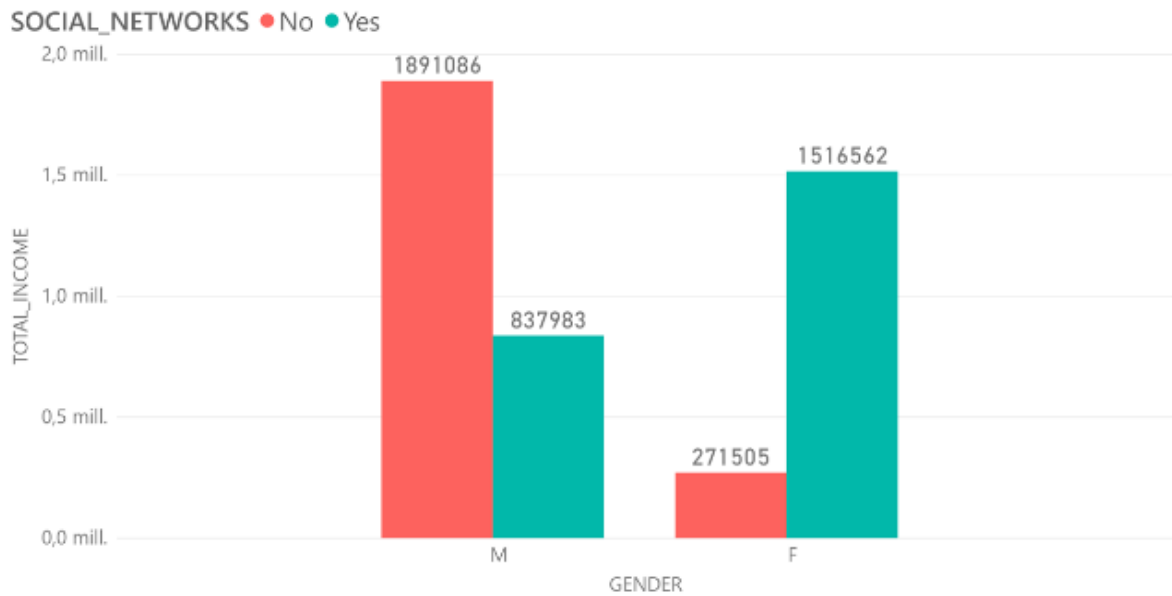
| EMPLOYEES NUMBER | Frequency | %    | % Valid | % Cumulative |
|------------------|-----------|------|---------|--------------|
| 0                | 5         | 2,8  | 5,5     | 5,5          |
| 1                | 31        | 17,3 | 34,1    | 39,6         |
| 2                | 20        | 11,2 | 22      | 61,5         |
| 3                | 11        | 6,1  | 12,1    | 73,6         |
| 4                | 4         | 2,2  | 4,4     | 78           |
| 5                | 3         | 1,7  | 3,3     | 81,3         |
| 6                | 2         | 1,1  | 2,2     | 83,5         |
| 7                | 5         | 2,8  | 5,5     | 89           |
| 9                | 2         | 1,1  | 2,2     | 91,2         |
| 10               | 1         | 0,6  | 1,1     | 92,3         |
| 11               | 1         | 0,6  | 1,1     | 93,4         |
| 12               | 3         | 1,7  | 3,3     | 96,7         |
| 14               | 1         | 0,6  | 1,1     | 97,8         |
| 19               | 1         | 0,6  | 1,1     | 98,9         |
| 25               | 1         | 0,6  | 1,1     | 100          |

In figure 3 (a), it is observed that the majority of MSMEs Employees work in informal Microenterprises (128). In figure 3 (b) it is observed that, according to the total amount of annual sales, Medium-Sized Enterprises are those that receive the highest income. Likewise, as observed in figure 3 (c), the Enterprises that invoice the most are those that are formalized, while the Enterprises that invoice the most are those that have e-mail services and are owned by men, such as shown in figure 3 (d).



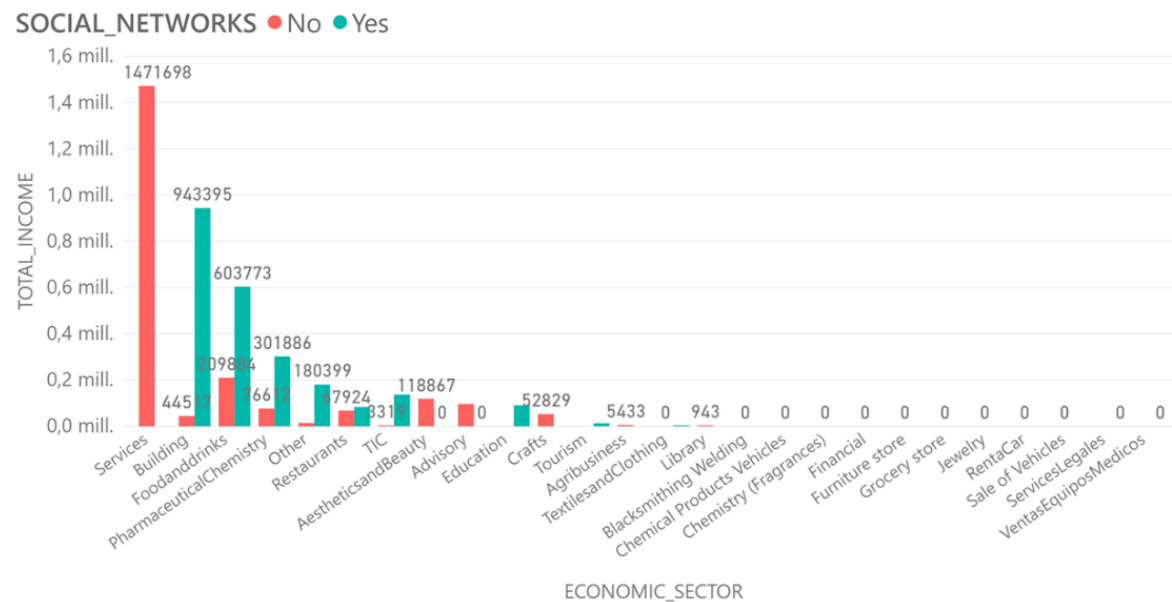
**Figure 3.** (a) Number of Employees by Enterprise Type and Enterprises Classification (b) Total Income by Enterprises Classification (c) Total Income by Enterprise Type (d) Total Income by Sex and who have email

A relevant fact is related to the use of digital technology. The Enterprises that invoice the most are those that does not have social networks and are owned by men, as shown in figure 4.



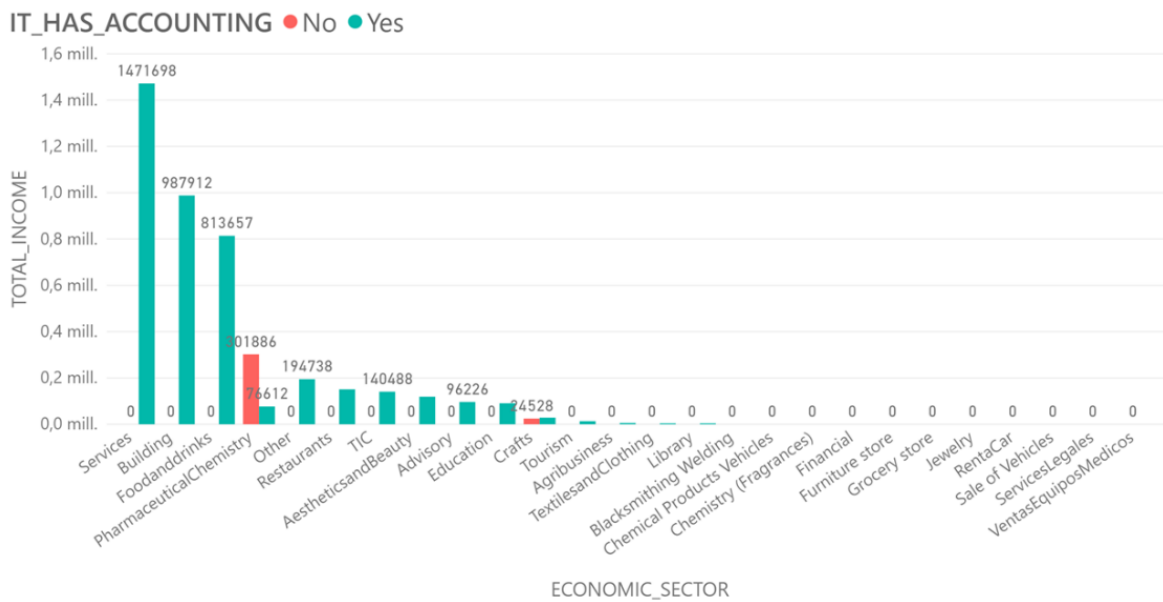
**Figure 4.** Total income by Sex and Social Networks

The economic sectors that invoice the most are Services, followed by Construction, Food and Beverages, and Pharmaceutical Chemistry. It can be seen in figure 5, that the Enterprises with social networks of the Economic Sectors of Services, followed by Construction, Food and Beverages, and Pharmaceutical Chemistry, invoice more than those without social networks. Even though the Internet, e-mail, social networks and cell phones are increasingly used massive technologies, only 73.2% of the Enterprises stated that they had e-mail; 30.2% have social networks for their Enterprises; and 89.9% have a cell phone.



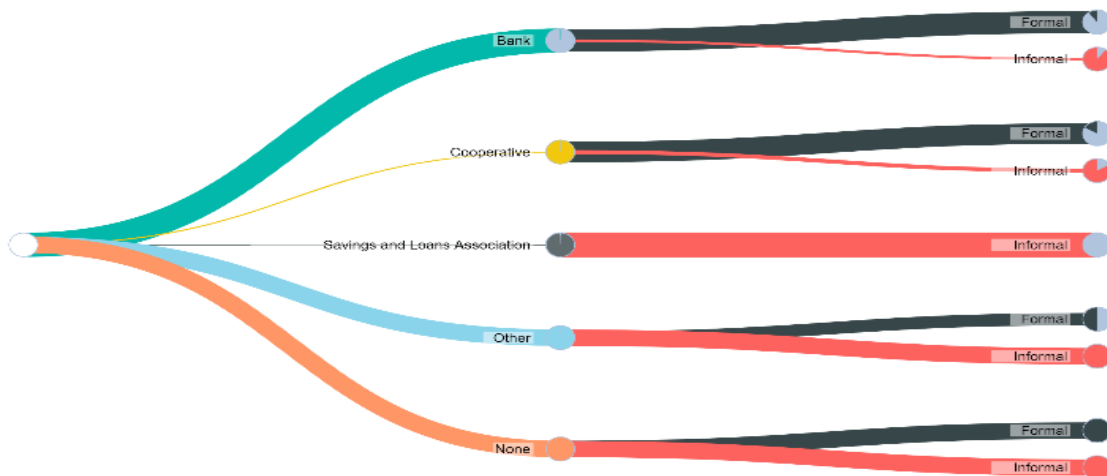
**Figure 5.** Total Income by Sector and Social Networks

When analyzing whether the Enterprises keep accounting (figure 6), it is evident that the Enterprises that keep it from the Economic Sectors of Services, Construction and Food and Beverages, invoice more than those that do not.



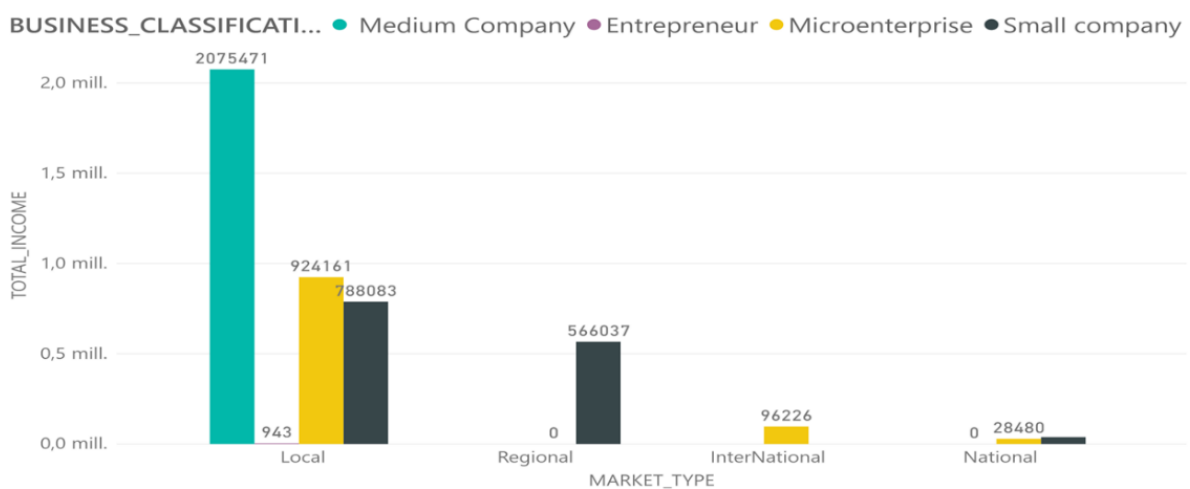
**Figure 6.** Total Income by Economic Sector and Accounting Record

When verifying the Information regarding access to the Financial System, it was observed that only 36.3% of the Enterprises served had access to credit. It can be seen in figure 7 that the loans that were granted, by type of granting entity, were mainly directed to legally formalized Enterprises (line with greater thickness).



**Figure 7.** Loan Values Obtained by Type of Enterprise and Bank Entity

In figure 8, commercial activity is concentrated mainly at the local level and that Medium-Sized Enterprises are those that obtain the highest income.

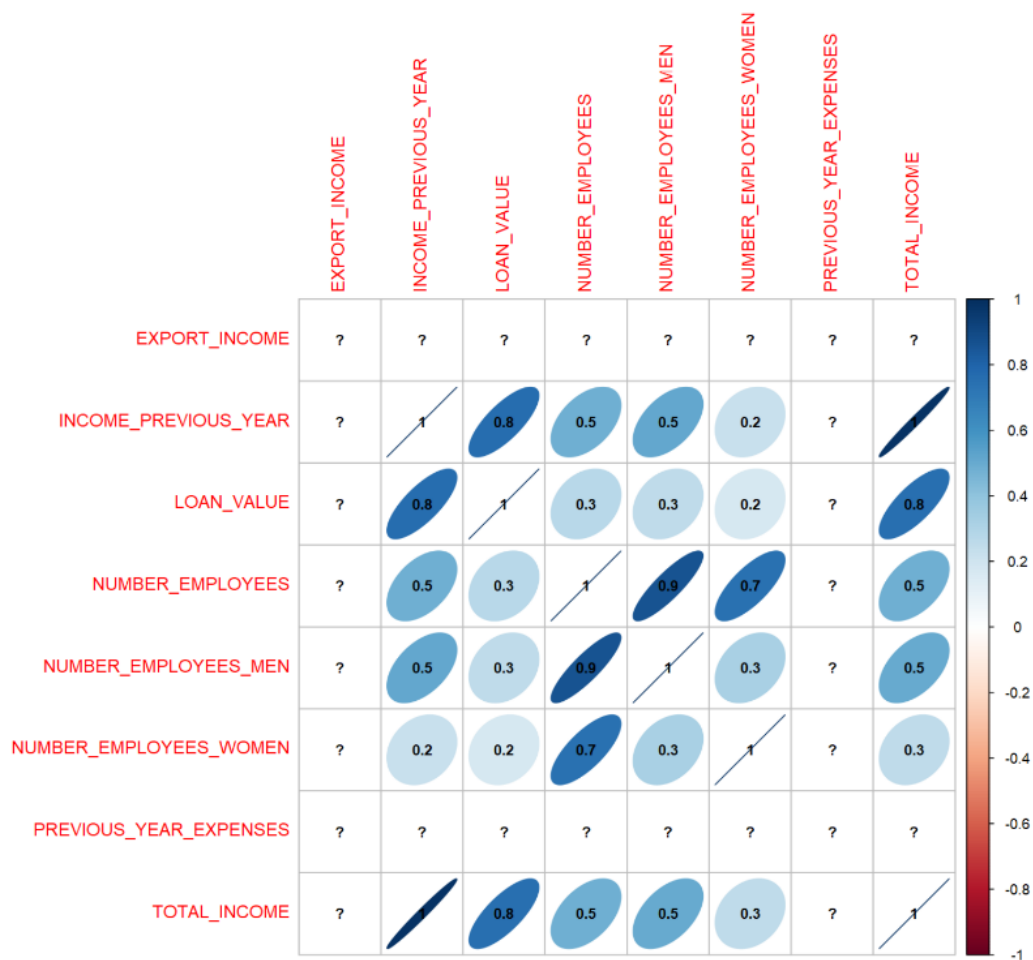


**Figure 8.** Total Revenue by Enterprises Market and Enterprises Classification

### 3.1. Statistics and Correlations

Given that some of the fields that are filled in the formats that are used, when starting some advice to a new MSMEs that goes to a MSMEs Center, are quantitative values, it is feasible

to make correlations with these fields, to measure the degree of relationship that may exist between some of these variables.



**Figure 9.** Correlation of Variables

With Power BI, using the Correlation Graphs function, you can quickly find the dependency between multiple variables at the same time. In figure 9, the Correlation Coefficients and the Value Obtained are shown. The dependency is seen with the naked eye, when the value is close to 1 or -1 and the elliptical that contains that value becomes more linear. In accordance with the above, for example, there is a dependency between the variables INCOME\_YEAR\_ANT and NUM\_EMPLEADOS\_HOMBRE and NUM\_EMPLEADOS.

#### 4. CONCLUSIONS

Business Intelligence (BI), when implemented effectively, can help organizations convert Data into Valuable Information for Enterprises Decision Making more effectively. Information Analysis reveals that only a small percentage of organizations have matured in their BI efforts to a point where they take full advantage of the value and usefulness of Organizational Information. According to this study, the organizations that are getting the most value from their data are those that are managing it in a very specific way, which makes the difference to success.

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