The Improvement of Decision-making Process using Business Intelligence Solutions

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The aim of this paper is to present the benefits of using Business Intelligence solutions for the improvement of decision-making process. Data and information are extremely important in the development of a business and in its process of becoming the leader of the market. Business Intelligence solutions offer the opportunity of using descriptive analysis in order to make informed decisions for businesses. These solutions offer the possibility of data visualization, which helps to obtain various benefits.
Key words: *Business Intelligence, data, information, descriptive analysis, data visualization, decision-making process*

1 Introduction

The remarkable development of the IT field has produced visible changes in all branches of the economy. Currently, globalization is constantly growing and its main effect is that there is stronger competition between economic agents than in the past.

Because we speak about rapid changes in the market, the management of companies has to take into consideration two aspects. The first is that they must make decisions based on information from real data about the business. The second thing is about the period of time in which they make these decisions. The success of a business depends on how quickly the business adapts to changes: in the market, in the customers behavior, and changes made by its other competitors. In order to make decisions, the management must obtain the information it needs in a timely manner. Finding good solutions to these changes leads to outperforming competitors and gaining an advantage over them.

The evolution of information systems began in the late 1970s when management information systems (MIS) appeared. Later, in 1980, decision support systems appeared, and in 1985, expert systems appeared. The 1990s are the starting point for the Business Intelligence systems.

The competitive advantages represent the elements that help differentiate the competitors in the market. This type of advantage is the element that makes the difference between businesses in the same market, the difference between a business that stays afloat and another that is constantly evolving [1]. The use of BI solutions offers the possibility of gaining these advantages, because all the information brought by these solutions helps in making well-informed and rapid decisions, which are beneficial for the company.

Business Intelligence solutions offer the possibility to analyze historical data and allow data presentation in a visual form. The analyzed data is related both to the actual activity of the company and to the business environment in which it operates. This is also the reason why BI solutions offer competitive advantages. Thus, the improvement of the decision-making process takes place. The main reason is the increase of the spectrum in the analysis of the company's performance.

1. Data – the source of information

People often confuse data with information, but these are completely different things. Data is the source of information, the raw material, and is not processed. The information is processed data, or we could say it is data with a certain meaning.

Businesses produce a large volume of data through the activity they carry on. By data processing, they obtain information of great interest and use. Businesses should do that in order to obtain new strategies, or to modify the existing ones so that the company's performance is at the level imposed on the market in which it operates. The analysis of information must be carried out in not a very short period of time, so that the decision is not erroneous due to the lack of aspects taken into consideration, but not too long, because another competitor might gain an advantage by making the same decision, but faster.

Data collection and storage should be a necessity for any company. This data is the basis for information that adds value to a company that processes and analyzes it in a timely manner. The management of a company can better understand the causes that led to a certain effect through performing data analysis. For example, businesses use data analysis to see the reasons for sales being lower in a certain unit of the company or a certain period. In this way, the company can find answers to many problems that arise and thus make decisions that help to develop the business.

In the absence of data, the decisions made do not have a basis on anything concrete, and these would be general decisions, not company-specific ones. Several factors fluctuate from one company to another, even if they have the same field of activity. Therefore, it is extremely important that the decisions made by the managers are based on the analysis of their own company's data.

2. Business Intelligence

This chapter is going to present the Business Intelligence process, data warehouses as support in the development of specific BI activities, and descriptive analysis.

2.1 The process of Business Intelligence

Business Intelligence represents the process of analyzing the data within a company in order to improve the decision-making process. BI systems combine data collection and storage with knowledge management and data analysis. By using Business Intelligence, companies receive answers to topics such as: business performance, profit, expenses, and the reasons that led to these results.

The next figure (**Fig. 1**) shows schematically the Business Intelligence process. The first element is the data sources. They are processed using BI tools. In this way, the users, usually the managers, get information that helps them make decisions. These decisions apply in the business environment, which then provides new data that is collected and stored in the data sources [2].
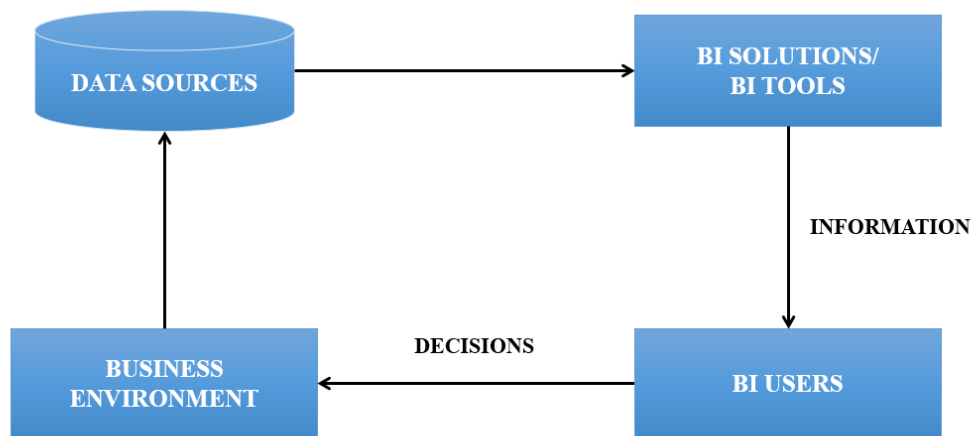
Fig. 1. Business Intelligence process
Source: Ana-Ramona Bologa, Mihaela Muntean – *"Business Intelligence.
Teorie şi practică"*, Bucharest: Editura ASE, 2015

2.2 Data warehouse

If we talk about Business Intelligence, we also talk about the company's historical data. Business Intelligence focuses specifically on the analysis of past data. As a result of the company's activity, the raw data collection is carried out. Data is transformed and processed and then stored in data warehouses. A data warehouse is a data management system used for enabling and supporting specific Business Intelligence activities. Compared to a relational database where we talk about transactional processing – Online Transactional Processing (OLTP), for data warehouses we talk about analytical processing – Online Analytical Processing (OLAP).

Because we consider data warehouses to be a support for Business Intelligence, we must understand that in data warehouses the most frequent operations are those of reporting and analysis. These operations are the opposite of the ones in relational databases, (in relational databases the most frequent operation is the actualization). The frequency of operations performed in these two cases is also different. For relational databases, we talk about daily operations compared to data warehouses where the operations performed assist the decisions, so they are much rarer.

The data sources that help to compile the data warehouse are diverse and different. For this reason, it is necessary to filter and transform the data. Data sources are made of both internal data, from the operational process, and from external data (data about the market evolution, competitors, business environment, etc.).

Business Intelligence helps process this data in order to obtain the necessary information in the decision-making process. The visual representation of information is more likely to be easier to understand than visualization of data in a much narrow context.

2.3 Descriptive analysis

Business Intelligence utilizes descriptive analysis as a method of interpretation of historical data. The main reason for using this analysis is to make comparisons. The most often used

key metrics in this type of analysis are those for prices, sales, products, and customers. This data helps with creating an overview of a company at a moment in time [3].

The descriptive analysis involves analyzing raw data to draw useful and understandable conclusions by decision-makers: managers, investors, and other stakeholders. A report showing a certain value of sales lacks context. In fact, this is the one that helps to give meaning to data. The context gives a view of the elements that led to the result achieved by the company in sales. A larger context helps to obtain an informed overview of the company's performance regarding different aspects [3].

There are two main methods of data collection in order to perform descriptive analysis, data aggregation and data mining. In order to obtain information from the data, it must be gathered and analyzed. The descriptive analysis is an important component of performance analysis. The information provides strong support for decision makers to analyze the performance achieved by the business [3].

3. Data visualization

The Business Intelligence process includes data management, but more precisely: data collection, data cleaning and storage, data analysis, and presentation. Data visualization is made according to the user preferences, in different shapes and formats.

People have a better ability to understand information when its presentation is visual, not just in writing. Visualization involves the use of images made of various visual elements of different shapes and colors. A visual analysis of a business's data has the aim to achieve the following objectives [4]:

- Visualization of key metrics for an easier and faster understanding of the data, in order to facilitate the decision-making process;

- Providing an interactive visual way for data exploration;

The benefits of visual data analysis are easy to notice. The main objective of data visualization is the possibility of improving the decision-making process. The means by which data visualization helps to make strategic decisions are the ones below [5]:

- Using a visual representation, we can obtain other information that we could not have noticed by visualizing the data in its raw form. Thus, by data visualization, you can see many of the information hidden behind the numbers, so the data analysis has a broader context.

- Data visualization is an important factor in identifying insights that lead to a better decision-making process. It gives the decision-makers information on different aspects of business's performance, in order to make decisions that are more effective.

- With help from data visualization, the decision-making process takes place in full knowledge of the facts, due to the clear perspective it brings on the values that establish the business's performance.

- Data visualization also helps to view business's progress and notice different trends. In this way, it is easier to notice any slip from the ideal situation and immediately fix it.

4. The benefits of using Business Intelligence

The economy is constantly changing, so decision-makers need to take into consideration many aspects in order to make the right decisions for the

development of their businesses and for achieving their desired performance goals, such as making a substantial profit. The aspects that need to be a part of this analysis have as sources data from the operational process and data about the business environment. Among the benefits brought by the use of Business Intelligence solutions, we can mention the following [6]:

- Performing faster data analysis using multiple data sources;

- Increasing organizational efficiency by reducing the time for data analysis;

- Making data-driven decisions by using up-to-date data;

- Improving the experience and satisfaction of customers by analyzing the data that came from them (for example, the customer's reviews);

- Improving the satisfaction of all employees by giving access to their own data, so they will not have to require data from the IT department;

- Using internal and external data sources for a rapid answer to questions;

- Increasing the competitive advantages by analyzing the market and the business's performance within it;

5. Microsoft Power BI
This chapter presents the Microsoft solution for Business Intelligence – Power BI Desktop and an example of application made with this tool.

In February 2021, Gartner considered Microsoft and its Business Intelligence tool – Power BI – among the leaders in the Analytics and BI platforms category. Alongside Microsoft, there are also solutions from Tableau and Qlik, as seen in **Fig. 2**.

Fig. 2. Magic quadrant for Analytics and Business Intelligence Platforms
Source: https://info.microsoft.com/ww-Landing-2021-Gartner-MQ-for-Analytics-and-Business-Intelligence-Power-BI.html?LCID=EN-US

5.1 Power BI Desktop

Power BI Desktop is a tool for data visualization that allows data transformation and modeling. Reports and dashboards are the final product of data visualization. Among the strengths of this Business Intelligence tool, we can include the reports, dashboards, and various types of data sources. The reports consist of several pages that contain various visual elements, such as graphs, diagrams, tables, etc. The dashboards are pages with multiple data visualizations. As the dashboards consist of only one page, they will contain the most important elements of the business's history [7].

The advantages of using Power BI Desktop are the ability to aggregate data sources, using the relationships between datasets, the interactive interface that facilitates data visualization and allows easier learning compared to other BI tools (such as Tableau and Spotfire); this is also the reason that the collaboration between departments for data analysis is encouraged [8].

5.2 Business Intelligence solution using Power BI Desktop

In order to explain the usefulness of Business Intelligence solutions in improving the decision-making process by using descriptive analysis and data visualization, in the following, we will see a solution made with Power BI Desktop, the BI tool of Microsoft.
Power BI offers the possibility to use various data sources, as seen in **Fig. 3**. Thus, the use of this tool provides flexibility for the company that uses it

because it can put together data from various file types, databases, cloud, online services, and others.
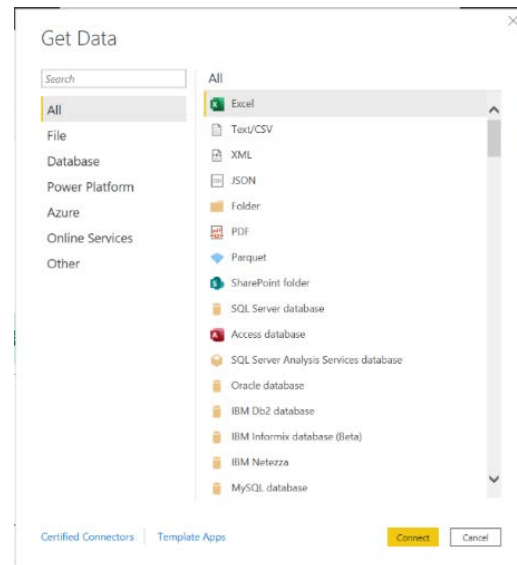

Fig. 3. Data source types used in Power BI Desktop

For this solution, we are using public datasets, two Excel files. These contain data about a company's customers, their orders, the company's profit, discounts, information on the economic regions that customers are from (EU – also presented as UE, EEA – also presented as SEE), and other data.

In order to be able to utilize the data, it must first be cleaned and shaped. Shaping data means that transformation is needed to be able to perform operations like changing formats, removing rows or columns, and renaming columns. In addition, we established the connections between the tables resulting from the datasets. **Fig. 4** shows the connections between the dataset tables.
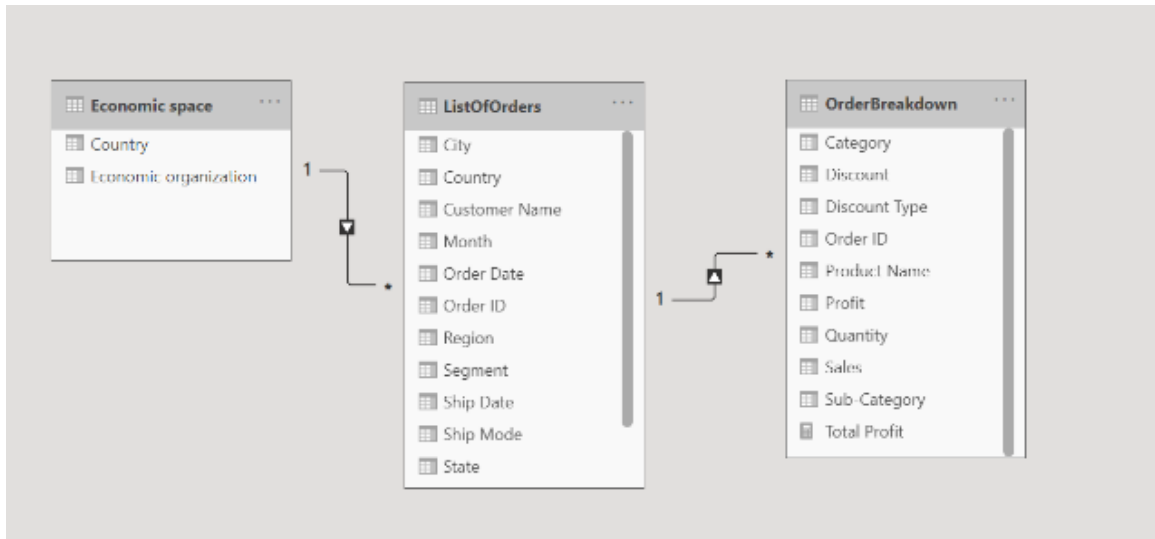
Fig. 4. The connections between the dataset tables

For the descriptive analysis of data, we made some reports and a dashboard that contains different visual elements.

In **Fig. 5**, you can see a report page, which contains a pie chart that shows the sales by region, a gauge for the profit made in every region and the total profit, and a matrix that shows the count of discount types given in every region.
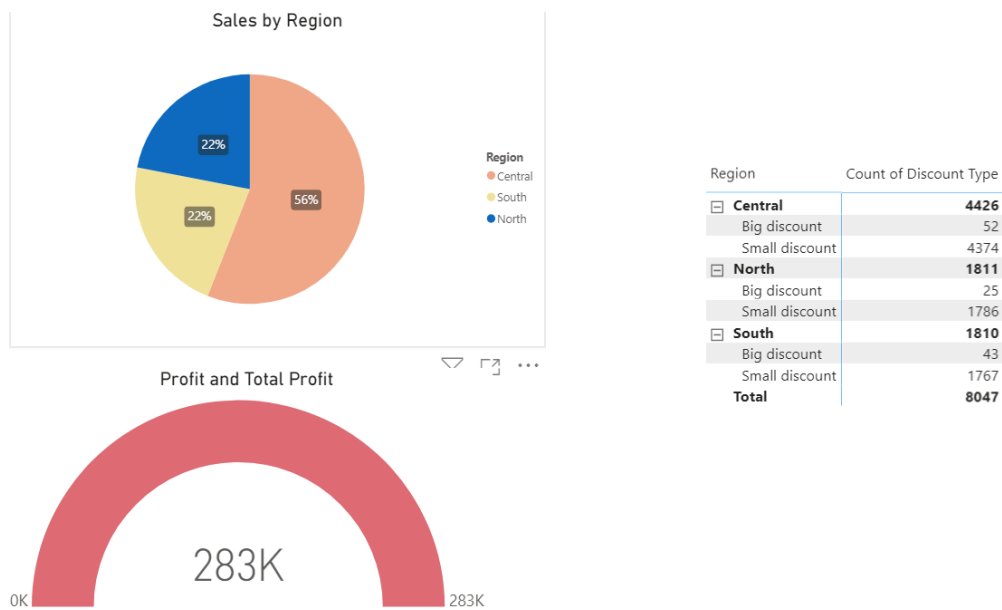

Fig. 5. Power BI report – example 1

In the report shown previously in **Fig. 5**, Power BI allows users to select a geographic region (Central, South, or North). In this case, the BI tool displays only data about the selected region in all the visual elements, as shown in **Fig. 6**.
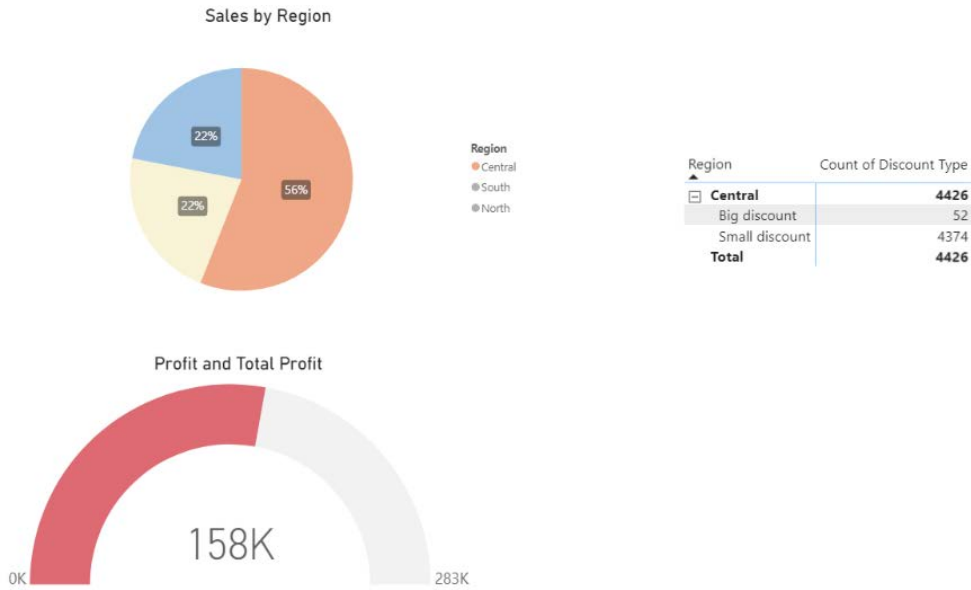
Fig. 6. Power BI report - region selection

In **Fig. 7**, we can see other aspects of this Business Intelligence solution, which helps in improving the decision-making process. This report includes data on product subcategories. The user can apply filters to the data. In this example, we can apply a filter on the year of order (in **Fig. 7**, we chose the year 2013). The decision-makers receive information about the subcategories of products with the highest quantities sold. They can also get information from the comparison between the sales by subcategory and the average of sales.
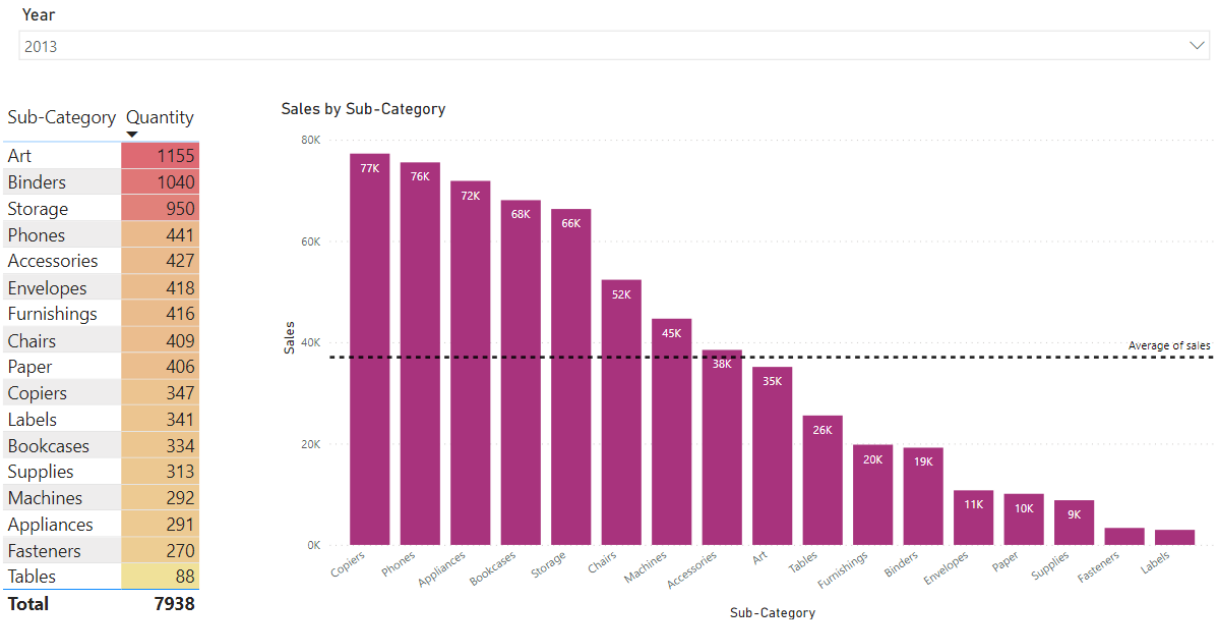

Fig. 7. Power BI report – example 2 – product subcategories

The Filled Map visuals are also easy to use and allow the users to understand the information much better. **Fig. 8** shows a Filled Map visual. In this case, through the map provided, the decision-makers can select an EU country for

which they want to see more information regarding aspects such as, number of orders, the revenue from sales, and also what is the preferred delivery type. In **Fig. 8**, we have information about France, which has a number of 991 orders, the sales revenue is 610 thousand euros, and the most popular delivery type is Economy. By selecting other countries on the Filled Map visual, users can see comparisons between the countries, so they can make decisions to improve their company's activity. For example, if managers see a barely used delivery type, they could give up on it.
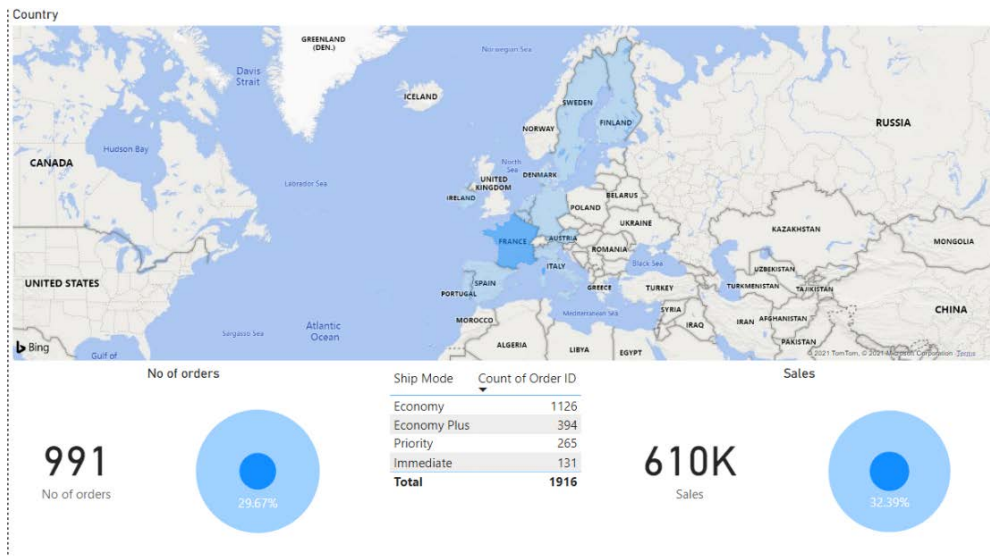

Fig. 8. Power BI report - example 3- orders and sales in France

As we have previously seen, Power BI Desktop offers the possibility of making reports, but with this BI tool, you can also create dashboards. In **Fig. 9**, we have presented a dashboard for this company. The dashboard's theme is sales by geographic and economic regions and contains visuals from the previously mentioned reports.
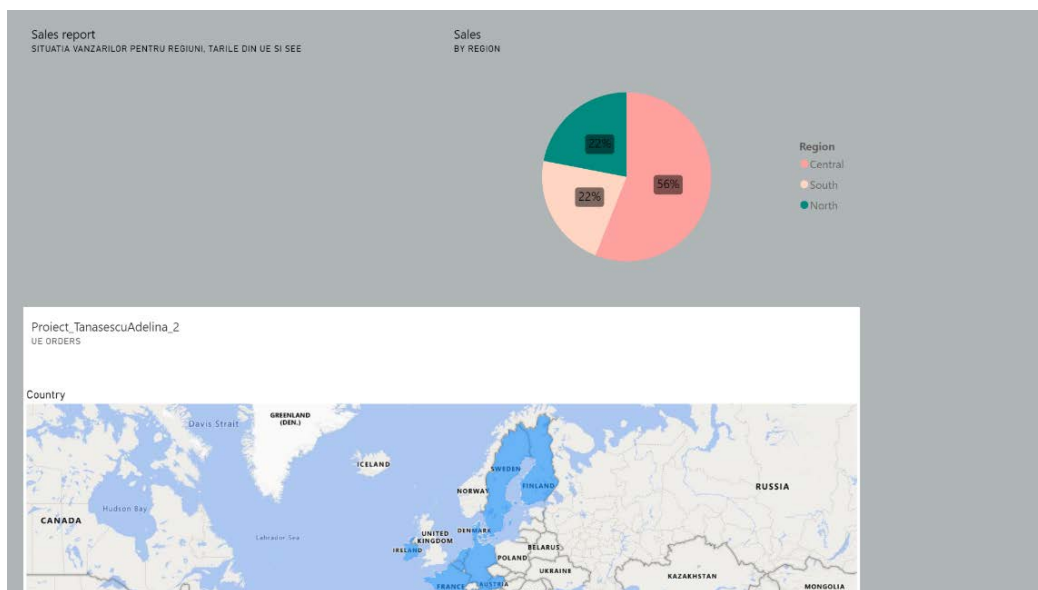

Fig. 9. Power BI dashboard

6. Conclusions

Firstly, through this assessment, we can certainly say that, at the moment, data has an impactful role in the economic process because, through their processing, the decision-makers obtain valuable information. Business Intelligence solutions aim to use data to improve the decision-making process.

Secondly, descriptive analysis is a part of the Business Intelligence process. According to the example given in Chapter 6.2, descriptive analysis plays a very significant role in the decision-making process because it helps a lot with historical data interpretation and comparisons between data at different moments. At the same time, the descriptive analysis creates a broader context for data interpretation and analysis of various factors.

Furthermore, data visualization probably has a major impact on improving the decision-making process. A Business Intelligence solution helps in this matter, and therefore it gives the support to present data from different sources, as they gather in one place. In this way, performing the analysis is much more efficient than in the case of a separate data analysis for every data source.

Finally, Power BI Desktop is a tool that helps to develop Business Intelligence solutions. The most important features are the ability to use many types of data sources and the interactive interface, which is extremely easy to use and allows for easy learning. By using this tool, the decision-makers will receive support for making correct decisions.

To conclude, Business Intelligence solutions help to improve the decision-making process. They provide the space to gather the data from various sources and to analyze it in a broader context. In this way, the company's management can make informed decisions that help in the company's development.

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