

XTraN Reports and Dashboards

Eliana Augusta Álvaro de Almeida

Abstract—There is a huge amount of data generated every day in the world. All companies deal with data, whether it is a lot or a few. As the amount of data managed by a company increases, so does the need to have an efficient management of these data, this is where Business Intelligence (BI) comes in, helping to manage data in a way that adds value to the business. The main objective of this work is to use Business Intelligence to improve the quality of services provided by a fleet management company named Tecmic, through reports and dashboards. XTraN is the professional Tecmic fleet management solution, the reports and dashboards will be used internally by the company's workers to have a more general picture of the events. It was possible to observe which vehicles had the most failures, the delays of the messages sent by the vehicles to the control station over time, to analyze the GPS signal quality over time, to identify the company's bottlenecks and have the possibility of improving them. A comparison was made between the leading BI tools on the market, and from the study made, Microsoft Power BI tool was the one that best suited the needs of XTraN, consequently, it was the chosen tool.

Index Terms—Business Intelligence (BI); Microsoft Power BI; Data Warehouse; Extract Transform and Load (ETL); Data Analysis



1 INTRODUCTION

NOWADAYS, a massive amount of data is produced every minute [1] – in every operation that is carried out at the cashier in a store, when entering a hospital, when uploading a video or a photo on social networks, when shopping online, when checking in at an airport, when registering on a website, when processing a document or when sending email, these are some examples of actions that we take in our day-to-day life and leads to the production of data. An operation that seems simple often leads to the production of a lot of data. It is increasingly urgent to find an efficient way to store the data and more importantly to find an efficient way to manipulate this data.

1.1 Motivation

A large amount of data by itself does not convey any meaning, becomes difficult to handle and does not add much value to the business. It is necessary to manipulate the data to extract useful and relevant information for a particular business. Business intelligence comes to meet this need and to support better business decision making.

The main objective of this work is to use Business Intelligence to improve the quality of services provided by a fleet management company named Tecmic in its XTraN solution, through reports and dashboards, to help in decision making, recognize failures in the systems, know the bottlenecks of the company, analyze trends, reduce the time of analysis of a problem and in this way, with the same amount of resources, provide a more efficient system.

XTraN is the professional Tecmic fleet management solution. XTraN combines the equipment installed in vehicles, a modern GPS location, communication techniques

and a complete management software, offering a complete solution for the professional management of employees and vehicles in many activity sectors. Whenever an in-depth analysis of its activity is carried out, weaknesses are discovered that need to be addressed. XTraN provides managers with the necessary tools for performing this analysis and based on this, improving their operational efficiency. All information of interest collected from the fleet flows through XTraN, eliminating the need for voice communications. All data and messages exchanged are archived within the system for later offline analysis. And it is on these data that the analyzes in the present work were carried out [2].

1.2 Stakeholder

The entity that has requested this project is the Tecmic - *Tecnologias de Microeletrónica, S.A.* Founded in 1988 [3], where in the beginning, the area of expertise was hardware and communications equipment. Today Tecmic also operates with software through the development of desktop applications, as well as mobile applications for navigation consoles/terminals by Global Positioning System (GPS), and web applications. Tecmic main area of business is the professional vehicle fleet management that allows its customers to increase the productivity and efficiency of their operations [4]. Also operates with mobility, asset and team management, waste collection management, passenger transport management, emergency and public safety, and electronic security management.

2 BACKGROUND

2.1 Business Intelligence

Business intelligence (BI) is a technology-driven process for analyzing data and show actionable information to help corporate executives, business managers and other end users make more informed business decisions. BI

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have a wide variety of tools, applications and methodologies that enable organizations to collect data from internal systems and external sources, prepare it for analysis, develop and run queries against the data, and create reports, dashboards, and data visualizations to make the analytical results available to corporate decision makers as well as operational workers. The potential benefits of business intelligence programs include accelerating and improving decision making; optimizing internal business processes; increasing operational efficiency; driving new revenues; and gaining competitive advantages over business rivals. BI systems can also help companies identify market trends and spot business problems that need to be addressed [5]. The Fig. 2.1. shows the architecture of Business Intelligence which is made up of data sources, Extract Transform and Load (ETL) process, optimized data storage (Data Warehouse and Data Mart), BI technologies that can be presented in different ways according to the defined purpose.

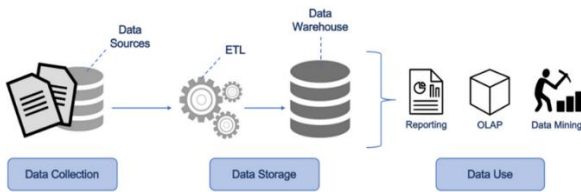


Fig. 2.1. Architecture of Business intelligence [8]

2.2 ETL

Extract Transform and Load (ETL) is a phase of BI that integrate and increase the value of data according to a set of rules, transforms data from heterogeneous sources to a common and clean format. It consists of 5 modules: data extraction, data validation, data cleaning, data conversion and data loading. ETL is a transfer process of data from data source to the target data warehouse and an important step of data warehouse implementation [6].

2.3 Data Warehouse and Data Mart

A Data Warehouse is a central database created for storing and organizing data from many disparate systems in one usable format, to make the data readily accessible for reporting, analysis, and planning. Making the data from all those sources useful and accessible for the organization.

A Data Mart is a more specialized tool with a similar purpose; it is a functional database that pulls information out of the overall Data Warehouse or even directly from source systems to answer specific queries. For example, a manufacturing location may need to compile some specialized data unique to the process used to make a particular product. The overall data warehouse is too big, and complex do that job, so a smaller version — a data mart — can be created for this one manufacturing location [7].

Data Warehouse databases usually have a star schema with one fact table in the middle and many dimensions

tables, as can be seen in the Fig. 2.2. A fact table contains the specific measurable, quantifiable, or numeric data, the primary data to be analyzed, for example a sales table. A dimension table contains the aspects of data items, for example a table that describes the products details. The star schema is simple to understand and involves fewer joins than other data warehouse schemas which makes it optimized for querying large data sets.

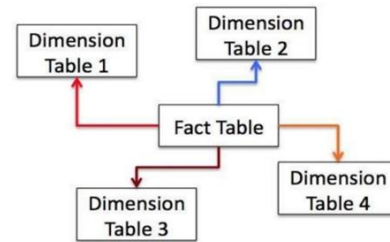


Fig. 2.2. Star Schema

2.4 Data Sources

The data used in Business Intelligence tasks comes from different sources, which contains data of varying quality, use inconsistent representations, codes, and formats. Thus, the problems of integrating, cleansing, and standardizing data in preparation for BI tasks can be challenging [9]. Data sources can be an Operational System, Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), SQL Databases, files, and spreadsheets.

Organizations use ERP software to automate business processes and gain a central hub for insights and controls. A modern ERP system draws on a central database that collects inputs from departments including finance, manufacturing, operations, sales and marketing and human resources (HR). Thanks to that central database, stakeholders gain cross-departmental insights that they can use to analyze various scenarios, perform financial planning and analysis and teasing out process improvements that can translate to major efficiency gains, cost savings and better productivity as people spend less time searching for needed data [10].

CRM is the building of a customer-oriented culture by which a strategy is created for acquiring, enhancing the profitability of, and retaining customers, that is enabled by an IT application; for achieving mutual benefits for both the organization and the customers [11].

2.5 BI Technologies

OLAP: Online Analytical Processing is technology that performs multidimensional analysis at high speeds on large volumes of data from a data warehouse, data mart, or some other unified, centralized data store [12]. OLAP systems are composed of OLAP Cubes, which add dimensions to the database. The Fig. 2.3. shows an example of a cube, with 3 dimensions (region, product, and Q),

each cube of the spectrum represents one value in each of the dimensions.

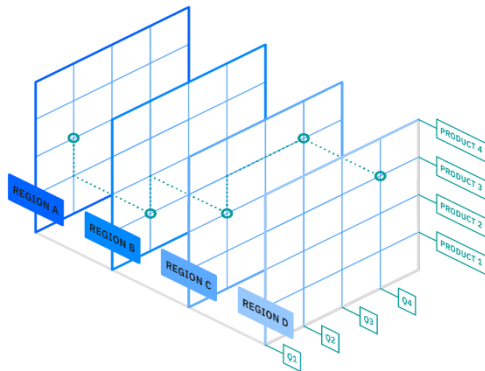


Fig. 2.3. OLAP Cube [12]

Data Mining: is the process of using complex mathematical algorithms to search for patterns in large amounts of data and making predictions. The more numbers fed into those math formulas, the greater the accuracy of the predictions [7].

Data Visualization: is the graphical representation of an information. The major goal of data visualization is to provide to the user a qualitative and easy understanding of the information contents. It is the process of transforming objects, numbers and concepts into a form that can be easily interpreted by the human eyes [13]. Reports and dashboards are two ways data can be visualized.

2.6 Microsoft Power BI

Microsoft Power BI is a collection of software services, apps, and connectors that work together to turn unrelated sources of data into coherent, visually immersive, and interactive insights. In the Business Intelligence Architecture, Microsoft Power BI is a data visualization tool and allows information sharing between collaborators.

2.6.1 Power BI Usage Scenarios

When a company decides to implement Power BI, it needs to make an in-depth analysis of its needs, the structure of the company, who will be the direct actors in the implementation and in the use of the tool, to correctly define an architecture that fits the intended objectives, to properly choose the licenses to acquire and create a system that really adds value to the business.

Power BI has many standardized usage scenarios, one of them can be chosen, or can be mixed or can be modified some according to what is intended. For practical reasons only two usage scenarios will be explained here. *Information in more details can be found at the Whitepaper [14].*

First scenario – Personal BI: Personal self-service BI scenarios, content is created for personal use, with no sharing or collaboration involved. The content author generally has a lot of freedom and flexibility. The Fig. 2.4.

shows the diagram of Personal BI scenario.

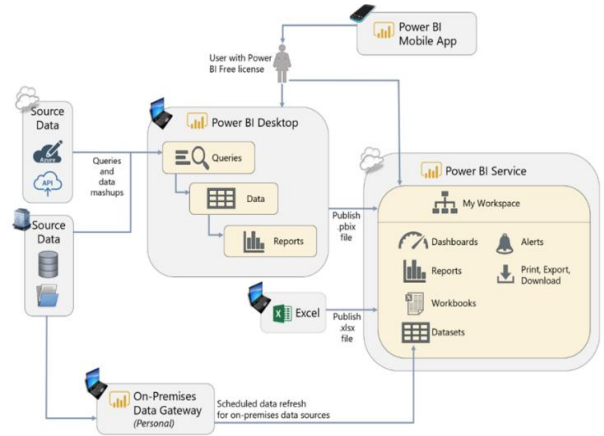


Fig. 2.4. Personal BI scenario [14]

Second scenario – Enterprise Content Distribution:

Very large enterprise BI implementations often employ a “top-down” approach because it is common for the Power BI content to be largely created and maintained by a centralized IT / BI team. Enterprise-level reporting scenarios commonly have a significantly larger number of read-only users who consume content, compared to a much smaller number of authors who create content to publish for others. A common way to cost-effectively support organizational/enterprise level reporting is via the use of Power BI Premium. The Fig. 2.5. shows the diagram of Enterprise Content Distribution scenario.

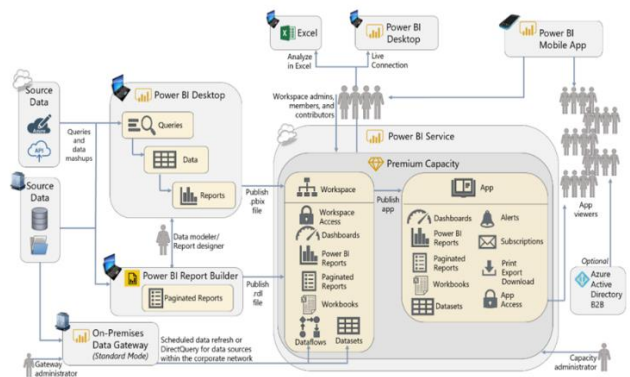


Fig. 2.5. Enterprise Content Distribution scenario [14]

2.6.2 Drill-Down, Drill-Up and Drill-Through

Drill-down is a feature on Power BI that reveal more detailed information about a data point. It is from more general information to more specific information.

Drill-up is a feature on Power BI that reveal more general information about a data point. It is the inverse of drill-down, and it is from more specific information to more general information.

The drill-down and drill-up are only possible with the use of hierarchy. Hierarchy is the data categorization and the establishment of different levels. For example, a total sales amount can be shown by country, then by region,

then by city and then by store. A hierarchy should be created between country as the most general information, region, city, and store as the most specific information. Drill-through is an option to navigate to a destination target page in the report that focuses on a specific entity that was selected.

2.6.3 Data Modeling

Data modeling is the process of analyzing and defining all the different data the business collects and produces, as well as the relationships between those bits of data. Data modeling concepts create visual representations of data as it is used at business, and the process itself is an exercise in understanding and clarifying the data requirements [15].

3 BI TOOLS COMPARISON

Microsoft Power BI is used by many thousands of companies around the world. Microsoft has been consistently ranked a leader on Gartner’s Magic Quadrant for Analytics and Business Intelligence Platforms, as can be observed in the Fig. 3.1.



Fig. 3.1. Magic Quadrant for Analytics and Business Intelligence Platforms 2022 [16].

Gartner highlights the following 12 capabilities as prime examples: security, governance, cloud-enabled analytics, data source connectivity, data preparation, catalog, automated insights, data visualization, natural language query, data storytelling, natural language generation and reporting. These capabilities are fundamental sources of differentiation between the propositions of the platforms. By assessing each of them closely, Gartner has separated each vendor into four categories: leaders, challengers, visionaries, and niche players [18].

Some features of leading tools are as follows: Power BI offers data preparation, visual-based data discovery, interactive dashboards and augmented analytics, it is available as a SaaS option running in the Azure cloud or as an

on-premises option in Power BI Report Server, Power BI Desktop can be used as a stand-alone, free personal analysis tool; Tableau offers a visual-based exploration experience that enables business users to access, prepare, analyze and present findings in their data; Qlik allows users of all skill levels to combine data and explore information without the limitations of query-based tools [19].

In the present work, only the leading tools on the market are of interest. In the next sections, a comparison will be made between these 3 tools, namely Power BI, Tableau and Qlik.

3.1 Power BI and Tableau Comparison

Market: Tableau has a market share in the data visualization of 16.96% with 63364 customers, according to Slintel, while Power BI has a market share of 14.95% with 55881 customers (in April 2022). It is worth noting that Power BI was released in 2015, 12 years after Tableau be founded, and it has quickly risen in popularity because of its ease of use and Microsoft affiliation. In the Data Visualization category, Tableau Software stands at 1st place by ranking, while Microsoft Power BI is at the 2nd place [17], this can be seen in the Fig. 3.2. While for the classification in the Business Intelligence tools, Power BI is in the first place, as can be seen in Fig. 3.3.

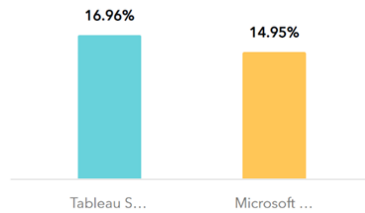


Fig. 3.2. Tableau and Microsoft Power BI market share in the Data Visualization (in April 2022) [17].

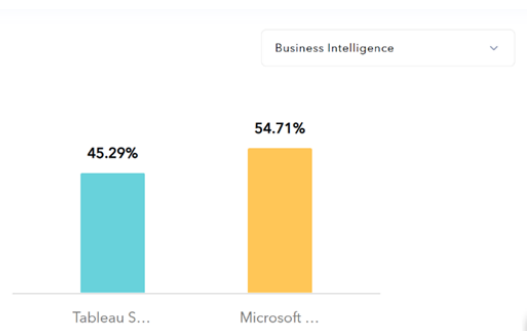


Fig. 3.3. Tableau and Microsoft Power BI market share in the Business Intelligence (in April 2022) [17]

Learning: For newer users and those who are not data analysts, Power BI is typically thought to be easy to use. Tableau is preferred by more experienced data analysts due to its higher learning curve.

Pricing: Power BI is often less expensive than Tableau. The Power BI Pro plan is \$9.99 per month for each user.

The equivalent Tableau package costs \$70 per month per user.

Tableau has a free tier called Tableau Public that is hosted on Tableau's Public Cloud. It is more suitable for people who are learning Tableau since it does not allow users to make reports private or store them in their local system. This means that anyone with Internet access can view these reports. Most businesses use Tableau to analyze sensitive business data and hence, it is not ideal for them to make their reports publicly available.

Microsoft Power BI offers a free tier with basic functionality. To access the advanced features, businesses have to purchase Microsoft Power BI Pro.

Based on the pricing for both tools, it can be concluded that Microsoft Power BI is a cheaper option as compared to Tableau. Microsoft Power BI is now also included in the Workspace Suite that most organizations rely on for workspace management. Hence, from a financial point of view, Microsoft Power BI is the best option.

Community: Tableau has a thriving Data Science community of over 220,000 users. A big community forum and over 500 global user groups are available. Tableau also offers conferences and virtual events such as Tableau Live discussion panels all over the world. When it comes to customer assistance, Power BI is more limited, with a smaller community forum.

Tableau requires time and expertise to understand, whereas Power BI is simpler to pick up and utilize. Tableau is best suited for seasoned data analysts, but Power BI can be utilized by both experts and beginners.

Tableau employs MDX (Multidimensional Expressions, is a query language for OLAP databases) for dimensions and measures. Whereas Power BI uses DAX (Data Analysis Expressions, which affects speed and reporting capabilities) [20].

3.2 Power BI and Qlik Comparison

Market: Comparing the customer bases of Microsoft Power BI and Qlik we can see that Microsoft Power BI has 61871 customers, while Qlik has 2278 customers (in September 2022). In the Data Visualization category, Microsoft Power BI stands at 2nd place by ranking, while Qlik is at the 28th place [21]. This can be seen in the Fig. 3.4.

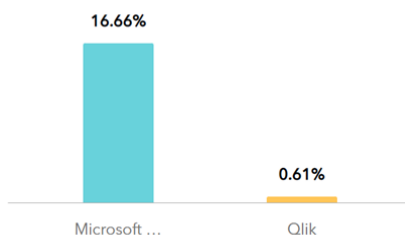


Fig. 3.4. Qlik and Microsoft Power BI market share in the Data Visualization (in September 2022) [21]

Deployment: Both Qlik and Power BI can be deployed on-premises and on-cloud.

Devices Supported: Qlik is compatible on devices such as Windows, Android, iPhone, iPad, Mac, and web-based platforms. Power BI is supported on Windows devices, Android, iPhone, iPad, and web-based platforms. Power BI is not supported on MAC devices.

Pricing: Qlik offers a free trial and a free version to the users. It has a quote-based pricing model where the customer needs to purchase a license for use. Its subscription starts from \$30 per month.

Company Size: Qlik is generally used in any scale (small, medium and large) enterprises and freelancing companies. Power BI is majorly used in medium-scale and large-scale enterprises.

Technical Customer Support: Qlik provides technical help and support to its customer round the clock via e-mail, phone, training, live support, and tickets. Power BI extends all kinds of customer support except for e-mail and live support options.

Usability: Qlik has better usability than Microsoft Power BI as it is a very simple, easy to use tool. All the functionalities and controls are simplified so much so that a user of any skill set can work on it. Power BI, on the other hand is also an easy-to-use tool but is more so for those users who are experienced in Microsoft tools like Excel and Power Pivot. To use Power BI to its full potential one must know the DAX language very well.

Return of Investment: Both the tools are worth investing in as customers are highly satisfied from them [22].

4 COMPANIES OPERATING IN THE TRANSPORT SECTOR

This section describes some companies that operate in the same sector as Tecmic – the transport sector in Portugal – and its Business Intelligence solutions.

4.1 Wegho

Wegho is a platform that provides services to homes and offices, each having a team of 2 or 3 suppliers, that travel using Wegho's vehicle fleet. Wegho currently offers services in different areas such as cleaning, painting, plumbing, electrical and fitness. Wegho currently targets both B2C and B2B channels and its services are available in Porto and Lisboa, Portugal. Most of the vehicles are equipped with GPS modules, provided by CarTrack - a company specialized in vehicle location systems. The GPS modules transmit location data and events to a CarTrack server [23].

Wegho has a framework that, in addition to performing real time location, trips history, schedule services, also do reports using Microsoft Power BI for their daily analysis.

4.2 HFIL Cargo

HFIL Cargo is a small Portuguese company that operates

in the road transport of goods sector, based in the municipality of Vagos, in the district of Aveiro. It is a company that carries out an economic activity essentially linked to general cargo transport services, which operates in European space, mainly in Portugal, Spain, France, Holland and Germany. HFIL Cargo has created a Balanced Scorecard to pursue the consolidation of the company's vision, using Microsoft Power BI, which allow to transform HFIL Cargo data into coherent, visually interactive and attractive information [24].

4.3 Sodicientro

Sodicientro is a company of the Auto-Industrial Group, official distributor and repairer of Mercedes-Benz and Smart cars, new and used, in Coimbra and Leiria [25]. Based on [26], was created a tool with Microsoft Power BI, to analyze the fleets of vehicles, used by the service that provides substitution vehicles for clients, with the aim of coming up with improvement strategies and tools that support fleet management while reaching the expected goals of reducing costs and identifying new business opportunities.

4.4 Pelichos, Lda.

Pelichos is characterized as an SME (Small and Medium-sized Enterprises) specialized in the transport of goods by road. With a 100% own fleet, equipped with the latest technological innovations in the area, Pelichos provides service throughout Continental Europe, with a special focus on countries such as Portugal, Spain, France, Luxembourg, Germany, Belgium, the Netherlands, Switzerland, Austria and Czechia, with light vans and trucks. Microsoft Power BI was used to develop dashboards for transport logistics planning [27].

5 IMPLEMENTATION

5.1 Tecmic SWOT Analysis

After having a clearer view of Business Intelligence, we can survey Tecmic's requirements, and find the solution that best fits the needs.

SWOT analysis is the evaluation of a company's Strengths, Weaknesses, Opportunities and Threats, with the aim of formulating strategies for its growth.

Through the Tecmic SWOT matrix in TABLE 1, it is possible to see that there is an opportunity to implement BI that is not yet being taken advantage of. Taking advantage of this opportunity, it is also possible to overcome the weaknesses described in the matrix, namely, discover the bottlenecks in the fleet management, extract relevant information from the data, and decrease the response time to anomalies occurring in the vehicles.

To implement the solution, we chose the Microsoft Power BI tool. It was the tool that presented the lowest cost, and it also has the free version with Power BI desktop, where can be performed various operations including creating reports and share them with the team. Sup-

ports a wide variety of data sources. XtraN uses Microsoft Sql Server to create and store databases, consequently Power BI would be the most suitable choice. Users who are already used to working with Microsoft tools such as Excel, for example, would easily adapt to Power BI.

TABLE 1
TECMIC SWOT MATRIX

Strengths <ol style="list-style-type: none"> 1) It is a company with a lot of experience in the market, with more than 30 years of existence. 2) Financial Solidity 3) Software as a Service (SaaS), accessible to all types of companies 4) High qualification of the commercial, development, engineering and technical assistance teams 5) Tecmic has the support of research institutions (such as Universities, for example) and Development, national and foreign, with solid alliances. 	Weaknesses <ol style="list-style-type: none"> 1) Long response time to the anomalies occurring in vehicles. 2) High amount of data stored in databases. Due to the high number of messages sent periodically by the devices. 3) Some bottlenecks in fleet management not yet discovered.
Opportunities <ol style="list-style-type: none"> 1) Evolution of business intelligence tools 2) IT companies are increasingly needed to meet the demands of the increasingly technological world. 	Threats <ol style="list-style-type: none"> 1) Globalization: each business is now competing in every market in the world 2) Economic instability

Before the implementation of reports and dashboards for XtraN, if any failure appeared in a vehicle, it was the customer who would have to contact Tecmic via email to communicate its failures, a case would be opened for the Support Team, the Support Team would go to the database, analyze the data and try to find out the reason for the failure, then communicate the solution to the customer, and if necessary, a Technical Team would move to the vehicle to solve the problem. This implied the time for the failure to be discovered by the customer, the time for contacting Tecmic, the time for researching and solving the case by the Support Team and the time for solving the failure by the Technical Team. With the existence of reports and dashboard, the Support Team run the reports periodically, with updated data and detect existing failures, solve them and, if necessary, send the Technical Team to the vehicle. There is a clear reduction in the time to solve the vehicles failures, there was also a reduction in the amount of communication needed.

5.2 Anomaly

An anomaly is a failure that can occur in the system. There are different types of anomaly such as: error while creating departures, error while loading departures, unit loading failure, driver surrender failure, and many others. For the data anomaly analysis, it was created a model in the Power BI desktop, with 2 tables – AnomaliesOccurred

table with the anomalies recorded, AnomalyTypes table with a description of each anomaly type – connected by a column named Type.

5.3 Events

An event is a message sent from a device to the control center, the device can be a console installed in the vehicles. For this analysis, it was created a model in the Power BI desktop, composed by 6 tables, shown in the Fig. 5.1.:

- CalendarTable it is a table with dates.
- SupportEvents table corresponds to the data table, containing the business process events that occurred over time.
- SupportEventTypes table contains the description of all types of existing events.
- SupportGroupVehicle as the name says, describes the group to which a vehicle belongs to.
- SupportGroupClient_GroupVehicle it is a junction table of SupportGroupClient table and SupportGroupVehicle table, to construct a many-to-many relationship between them.
- SupportGroupClient describes the group of clients to which a vehicle belongs to.

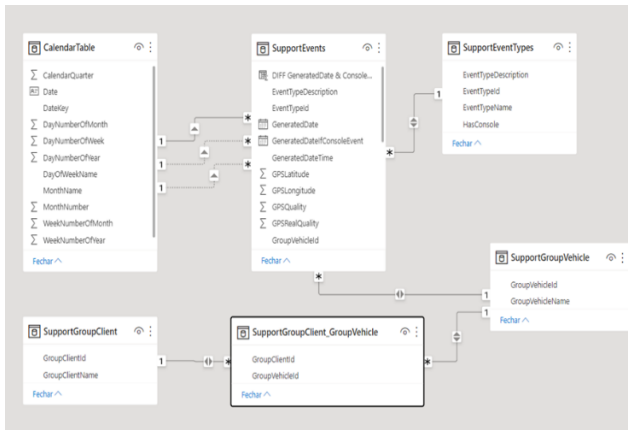


Fig. 5.1. Data Model of Events Analysis

6 EVALUATION

Two analyzes were carried out: one on the events recorded by vehicles in the Tecmic and another on the anomalies of these vehicles.

6.1 Anomaly Analysis

For this analysis, data were obtained from Tecmic's database in the production environment. Two tables were extracted, one of the anomalies that occurred and another of the existing types of anomalies, to an excel file with the size of 650KB. This file was later used as a data source in the Power BI. A report was created in which we could see the number of anomalies that occurred for each On-board equipment ID (UmID), and the total number of anomalies by year, quarter, week, month and day for the different types of anomalies. Fig. 6.1. shows that.

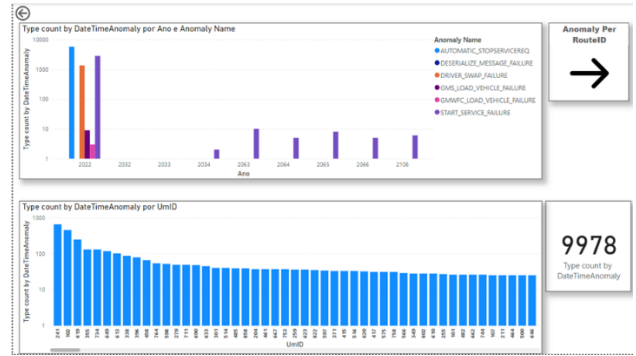


Fig. 6.1. Anomaly Analysis Per UmID

6.2 General Analysis

For the event analysis the data were obtained from Tecmic's database in the production environment. Five tables were extracted, namely: SupportEvents, SupportEventTypes, SupportGroupVehicle, SupportGroupClient_GroupVehicle and SupportGroupClient, to an excel file with the size of 48.2MB. This file was later used as a data source in the Power BI. The CalendarTable was created using M language in Power Query Editor. Given the data and the model in section 5.3, we were able to do some analysis on it, and extract relevant information. In Fig. 6.2. we can observe some measures and through this we can draw some conclusions about the quality of the data. The first chart named "Delay ConsoleDate & ProcessedDate (%)", represents the percentage of the delay between the ConsoleDate and ProcessedDate greater than a certain time threshold, above this, we put a filter in which we can determine the considered delay time threshold, in minutes. From the left to the right, the second and third chart, have the same meaning as the first chart but for "GeneratedDate and ProcessedDate" and "GeneratedDate and ConsoleDate".

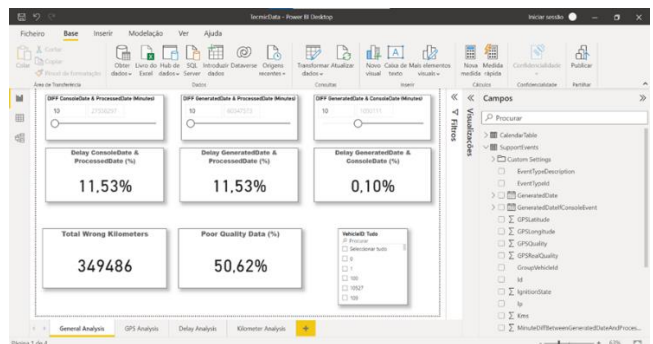


Fig. 6.2. General Analysis

The fourth chart named "Total Wrong Kilometers" represents the total number of rows in the table which a kilometer of a certain vehicle with more recent GeneratedDate has a lower value than a kilometer of this same vehicle with older GeneratedDate. A data is considered being with poor quality when the GPSRealQuality in the Sup-

portEvents table is less than 3. The fifth chart named “Poor Quality Data (%)” represents the percentage of all data which have poor quality.

The sixth element is a filter, which allows you to select and filter all graphics by vehicle identifier.

6.3 GPS Analysis

From Fig. 6.3. can be seen the first chart named GPS Analysis represents the real GPS quality for each vehicle over time. On the Y axis we have GPSRealQuality values ranging from 0 to 4, with 4 being high quality. On the X axis we have a hierarchy, with GeneratedDate, VehicleID and GeneratedDateTime, the last one representing the exact time of event occurrence. Here it can be used the drill-down and drill-up features to expand or retract the data, to obtain different points of view of the information.

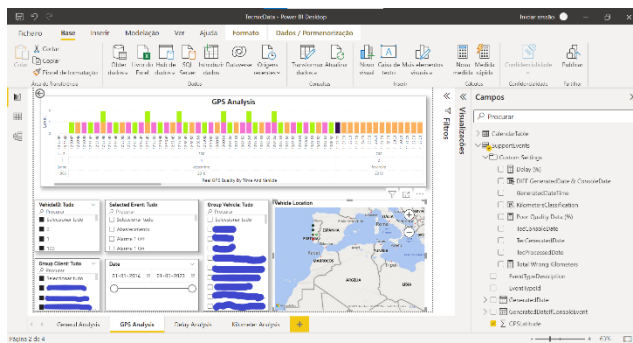


Fig. 6.3. GPS Analysis

6.4 Delay Analysis

From Fig. 6.4. can be seen the first chart named “Delay Analysis” represents the delay between GeneratedDate and ProcessedDate for each vehicle over time. On Y axis it is the difference in minutes between GeneratedDate and ProcessedDate. On the X axis we have a hierarchy, with GeneratedDate, VehicleID and GeneratedDateTime, the last one representing the exact time of event occurrence.

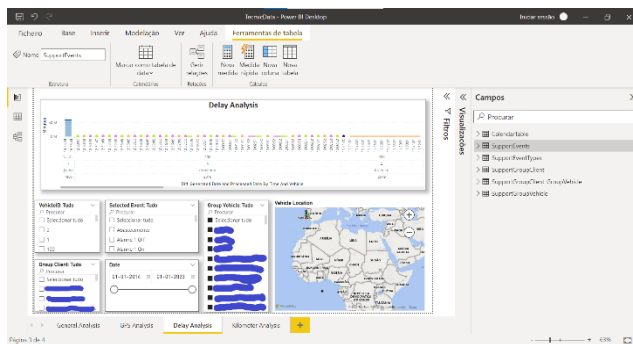


Fig. 6.4. Delay Analysis

6.5 Kilometer Analysis

The first chart in Fig. 6.5. named “Total Wrong Kilometers

rows per Vehicle” presents for each vehicle the total number of wrong kilometers. The other elements in figure are filters, we can filter the data of Total Wrong Kilometers rows per Vehicle chart by the VehicleID, EventType-Name, GroupClientName, GroupVehicleName and by a date range.

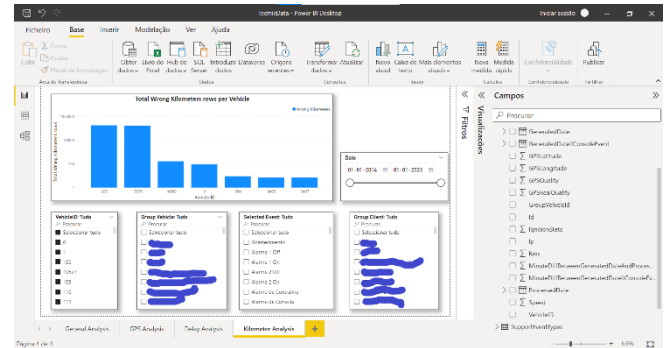


Fig. 6.5. Total Wrong Kilometers

7 CONCLUSION

The Business Intelligence (BI) industry has grown fast and has helped business leaders to make the right decisions for their business. It has become indispensable for companies that care about their growth and the quality of services provided. There are many BI tools available on the market, the right tool is the one that meets the company's requirements, with the best balance between the cost and the benefits obtained. There are already many companies in the Portuguese market in the transport sector that have used BI tools to help manage their business. Power BI has been quite prominent within the Portuguese market, as it has been one of the preferred BI tools by companies.

Tecmic, a fleet management company, wanted to implement BI in its XtraN platform, in order to reduce the response time to the failures in the vehicles of the managed fleets, obtain information from the database faster, and discover bottlenecks in fleet management, through reports and dashboards. A study was carried out of the leading BI tools in the market and the conclusion reached is that Power BI is the one that best fits the Tecmic requirements.

From the analyzes made, through the reports and dashboards built, it was possible to observe:

- The number of anomalies that occurred in the system per year, per quarter, per week, per month and per day, for each different type of anomaly.

- The number of anomalies by equipment.
- The total number of anomalies occurred.
- GPS quality analysis.
- Messages delay analysis.
- The number of wrong kilometers recorded by each vehicle.

It is then possible to conclude that the analyzes made through the reports and dashboards, were able to reach all their expectations and brought benefits to the company in terms of improvement in the quality of the service provided.

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