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**Implementation of a business
intelligence solution: a case study of a
workforce and staffing solutions
company**

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Abstract

In the digital age in which we are currently living, information is considered a fundamental resource for companies, playing an important role in their strategic planning and decision-making process. This high volume of information that exists leads to the need to filter it, with companies having to be able to implement systems that can extract and analyze the data produced by organizations. Business intelligence (BI) systems respond to this need, providing the ability to extract and analyze information much faster in order to improve the decision-making process.

In this report, it was made a description of the processes carried out during the curricular internship at the company DevScope, S.A., where a BI solution was developed for one of its clients, the “HR Connect” company, to respond to a problem identified by the company. This problem was the lack of quick information gathering that the Chief Executive Officer (CEO), so that he was able to understand the current situation of the company at all times. HR Connect, a company that operates in the human resources sector, wanted a solution to be developed that would serve as a decision support system, capable of extracting the data contained in the various data sources and presenting the information collected through dashboards.

To understand the importance that the development and implementation of a BI solution can have for an improvement in the performance of an organization, a literature review was carried out on this topic, and the solution was then implemented in accordance with the customer’s needs. Throughout this report, all the steps followed for the implementation of the BI solution are described, to understand the importance that it can have for an improvement in decision making.

Keywords: Business Intelligence, Business Performance Measurement, Business Strategy, Key Performance Indicators, Dashboards.

Resumo

Na era digital em que estamos a viver atualmente, a informação é considerada um recurso fundamental para as empresas, tendo um papel importante no planeamento estratégico e no processo de tomada de decisão das mesmas. Este volume elevado de informação leva à necessidade de filtrar a mesma, tendo as empresas de serem capazes de implementar sistemas que sejam capazes de extração e análise dos dados produzidos pelas organizações. Os sistemas de *business intelligence* (BI) dão resposta a esta necessidade, providenciando a capacidade de uma extração e análise da informação muito mais rápida de forma a melhorar o processo de tomada de decisão.

Neste relatório, foi feita uma descrição dos processos realizados durante o estágio curricular na empresa DevScope, S.A., onde foi desenvolvida uma solução de BI para um dos seus clientes, a empresa “HR Connect”, para dar resposta a um problema identificado pela empresa. Este problema era a falta de uma recolha rápida e eficaz da informação necessária ao *Chief Executive Officer* (CEO) para que este fosse capaz de perceber a situação da empresa a cada momento. A HR Connect, empresa que opera no setor dos recursos humanos, pretendia que fosse elaborada uma solução que servisse como um sistema de apoio à decisão, capaz de extrair dados contidos nas várias fontes de dados e apresentar as informações recolhidas através de *dashboards*.

De forma a perceber a importância que o desenvolvimento e implementação de uma solução de BI pode ter para uma melhoria no desempenho de uma organização, foi efetuada uma revisão da literatura sobre esta temática, sendo depois implementada a solução em conformidade com as necessidades do cliente. Ao longo deste relatório são descritos todos os passos seguidos para que a implementação da solução de BI, de forma a perceber a importância que esta pode ter para uma melhoria na tomada de decisão.

Palavras-chave: *Business Intelligence*, Medição de Desempenho de Negócios, Estratégia de Negócio, Indicadores Chave de Desempenho, *Dashboards*.

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Acronyms and abbreviations

BI – Business Intelligence

CEO – Chief Executive Officer

DAX – Data Analysis Expressions

DSS – Decision Support System

DW – Data Warehouse

ETL – Extract, Transform and Load

GASHA – Guysborough, Antigonish, Strait-Area Health Authority

IBM – International Business Machines Corporation

IS – Information System

IT – Information Technology

KPI – Key Performance Indicator

OLAP – Online Analytical Processing

OLTP – Online Transaction Processing

PMS – Performance Measure System

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1. Introduction

This initial chapter of the internship report begins by referring to the research context, to understand the motivation for carrying it out. Throughout the chapter, the research objective is mentioned, as well as the methodology used. The chapter concludes with a description of the structure of the document, providing information regarding the remaining chapters developed throughout the project.

1.1. Research context

Information has become an increasingly important resource for a company to be able to fight the constant pressures of an increasingly competitive business scenario. Thus, the quality of information has become crucial in the activity of companies, and one of the company's objectives has become the supply and analysis of information relevant to the business (Athamena & Houhamdi, 2019). Thus, the implementation of an information system (IS) can have a positive impact on decision making beyond the organization, which must be committed to perceiving the information provided by the system and making a strategic analysis of it (Jayakrishnan, 2020). Thus, the importance that business intelligence (BI) had to carry out an analysis of information related to a company was studied, and how this could impact business decision-making.

The internship was carried out at DevScope, a software development company based in Porto, lasting four months, between March 2022 and June of the same year. Operating in several areas, such as artificial intelligence or web and app development, DevScope has a strong commitment to the BI area, providing a deployment of the BI infrastructure to its clients and the development of its strategy. In addition, the company also carries out an improvement in the quality of the database, assistance with personnel training to adopt the BI solution and with the implementation of tools to improve the experience with Power BI.

Although the company focuses a lot on the more information technology (IT) part of the solutions provided to its customers, it was proposed that the project developed in this internship also focus on the economic bases related to the implementation of the BI solution.

The project developed during the internship involved developing a BI solution for one of DevScope's clients, HR Connect, in view of the needs referred to by the company.

1.2. Objective of the research

The problem presented by HR Connect and which led to the development of this report was the lack of quick collection of information necessary for the Chief Executive Officer (CEO) to understand the current situation of the company. The main objective of the report was to understand how it would be possible to respond to the problem presented by the company. Thus, a BI solution was developed, capable of providing centralized information capable of assisting in the decision-making process. To answer the question, a literature review on BI and the performance measurement of a company was carried out to support the development and implementation of a BI solution at HR Connect.

It is intended to make known the different phases in this implementation process, from the gathering of customer needs to the final feedback of the solution provided by the customer. After carrying all this steps, it is expected that the BI system developed will be able to provide the CEO of HR Connect with a set of mechanisms capable of collecting, exploring, and analyzing all relevant information about the company's activities. The indicators used in the solution must also provide relevant and reliable information, and it is important that the choice of these indicators was justified.

1.3. Research methodology

Based on the research problem presented and the solution that was intended to be developed, the following research methodology had to be understood. In this way, it was concluded that carrying out a case study would be the most advisable. To deepen the research methodology used in the development of this project, an analysis of the methodology was developed in chapter 3. The particularities of carrying out a case study are thus presented, as well as the way to develop a case study, through its preparation and the collection of evidence.

After the challenge imposed by one of DevScope's customers was presented, it was possible to define an action plan to meet its objectives and which allowed the preparation of

this report. Thus, in methodological terms, there was a first need to carry out a literature review to frame and clarify the concepts related to the problem under study.

In a second phase, an empirical approach was adopted, following a set of phases to enable a successful implementation of the BI solution at HR Connect. In this phase, the methodology for the development of BI projects was considered, based on the perspective presented by Kimball and Ross (2013), of a lifecycle roadmap for the development of BI projects. To develop the BI solution, it was necessary to collect evidence that allowed me to understand the specifics of the company for which the solution would be developed. This collection of evidence emerged through two interviews with the CEO, one in the pre-implementation phase of the solution and the other after, as well as an analysis of documents provided directly by the company and on its website.

1.4. Report structure

This report consists of six chapters. This first chapter contextualizes the project and provides the questions to be answered, a summary of the research methodology, and the structure of the report. The next chapter presents the literature review of the key concepts to base the study with current and solid knowledge. The third chapter of this report describes the research methodologies carried out. It describes the procedures carried out to collect the data necessary for the case study and technologies used for the development of the BI solution. Chapter four aims to describe HR Connect, presenting the activities developed by the company, as well as a set of characteristics of the same to develop a customer profile. In the next chapter, all the steps taken to implement the BI solution were described, trying to establish a relationship with the literature review. The sixth and last chapter of this report is dedicated to the presentation of the conclusions, making a reference to the limitations that have arisen and to suggestions for future works.

2. Literature review

In this chapter it is possible to find the literature review carried out. Thus, an analysis was made of the main concepts that supported the work developed, starting this chapter with an analysis of the BI concept. After that, a description of the architectures of the BI solutions is made, followed by an analysis of the dimensional modeling of the data and an enumeration of the benefits and challenges related to the implementation of a BI solution. Next, the importance of measuring the performance of a business is mentioned, with a characterization of the performance dashboards through which the measurement is made and the indicators used to perform it. Finally, the chapter ends with an analysis of the limitations and myths related with performance measurement.

2.1. The concept of business intelligence

To understand the emergence of the term BI, it is necessary to take a trip to the past. Although the term BI was coined in 1989 by Howard Dresner, a researcher at the Gartner Group at that time and recognized by many as the father of BI, this concept had already been referred to by Hans Luhn in 1958 (Abai, Deraman, Hamdan et al., 2019; Abai, Deraman, Jusoh et al., 2019; Chee et al., 2009; Elena, 2011). In an article published in the IBM Journal, Luhn defined business as “the collection of activities carried on for whatever purpose, be it science, technology, commerce, industry, law, government, defense, etc.”, then defining intelligence as “the ability to apprehend the interrelationships of presented facts in such a way as to guide action towards a desired goal” (Luhn, 1958, p.314).

In Howard Dresner's most modern definition, he presented BI as an umbrella term to describe a variety of software and solutions capable of collecting, processing and analyzing a set of data, allowing business players to improve decision-making and easier access to the data (Abai, Deraman, Hamdan, et al., 2019; Chee et al., 2009; Elena, 2011). More recently, Maharjan (2019) and Habibi et al. (2019) argue that BI evolved from decision support systems (DSS), which had its emergence in the 1960s and developed in the 1980s until the definition promoted by Dresner. Trying to understand the development of BI from the DSS, Wei et al. (2001) and Asghar et al. (2009) argue that the difference between them is that while in traditional DSS its users are restricted to being just the leaders and agents who make decisions in a company, in a BI system its users can be anyone in an organization. Thus, in

addition to being able to integrate all agents within a company, users of the BI system may also be users outside the company, “such as customers, suppliers and partners” (Wei et al., 2001, p.296).

In the same line of thought, Boonsiritomachai et al. (2016), Lönnqvist and Pirttimäki (2006) and Pejić Bach et al. (2019) define BI as an organized and systematic process, implemented by companies to collect, analyze and disseminate external and internal information about their activities. This information can describe the business environment, the organization and its situation vis-à-vis the market, customers, competitors, and other economic issues.

2.2. Architecture of a business intelligence system

To be efficient, BI projects need planning, being affirmed by Moss and Atre (2003), the existence of six necessary steps to carry out these projects effectively. Thus, the project stages referred to are: justification stage; planning stage; business analysis stage; design stage; construction stage; deployment stage. In addition to the existence of these six stages, the same authors also mention several steps associated with each of the stages that companies are advised to develop. Thus, it is important to realize that the process of implementing a BI system is usually long and laborious, with the company having to make several efforts (Anwar et al., 2021; Nedelcu, 2013).

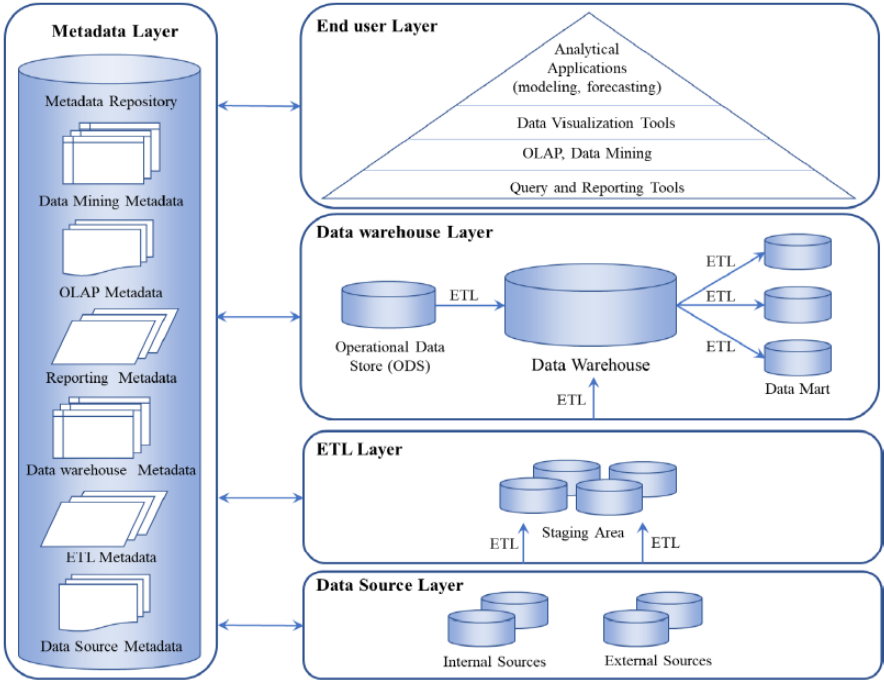
The BI architecture plays an important role in the implementation of this process, which is defined by Pratt (2020) as the structure by which data, information management, and technology components used to collect, integrate, and store the data are organized to build the BI systems. If the BI architecture is not solid and well designed, this can have serious consequences for the company that will implement the system (Łabędzka, 2018; Ong et al., 2011), as it can lead to “inability to share information among the components, inability to meet business requirements, and poor business performance” (Ong et al., 2011, p.2).

This need for the existence of a BI architecture has given rise to the emergence of several architectures in the literature (David et al., 2010; Ong et al., 2011; Watson & Wixom, 2010), presenting differences between them, at the level of layers, processes, components, or relationships (Hightower Jr & Shariat, 2007). In the article by Ong et al. (2011), the authors present a BI architecture with the objective of improving architectures presented by other

authors, referring that they missed an important component of analytical and reporting, such as data mining, predictive analysis, or data visualization.

According to Llave (2018) and Ong et al. (2011), a BI system must have an architecture similar to that presented in Figure 1, presenting five layers, namely data source, extract, transform and load (ETL) process, data warehouse (DW), end user, and metadata layers.

Figure 1 - Architecture of a BI system



Source: Ong et al. (2011)

The data source layer concerns the acquisition and processing of data related to the company, which can be obtained within the organization, collecting information about customers, sales, or products, or from external sources, obtaining information about the market and competitors (Ereth & Baars, 2020; Ong et al., 2011; Palanivel, 2019). This is possible through online transaction processing systems (OLTP), capable of recording all these business transactions in real time and updating whenever necessary (Kimball & Ross, 2013).

The second stage of this process show in Figure 1 happens when companies extract the relevant data from the sources where they collected them in the previous moment, then

transforming this data through operations such as combination, integration, and aggregation to obtain a consistent format for reporting and analysis (Ereth & Baars, 2020; Palanivel, 2019; Watson & Wixom, 2010). Finally, the data that are already in this format and placed in the staging area are loaded into the DW, which is the last phase of this process known as the ETL process (Ong et al., 2011).

The third layer referred to by Ong et al. (2011) is the DW Layer, which is composed of three components: operational data storage, DW and data marts. According to the authors, operational data storage integrates the data that comes from the ETL process, placing them later in the DW. The second component represents “the central storage of data from internal and external resources” (Ong et al., 2011, p.5), having important functions, as it can represent the past, relieving the systems of origin of this function (Ereth & Baars, 2020; Kimball & Ross, 2013; Palanivel, 2019). Finally, data marts are characterized as being a subset of data contained in the data warehouse, having a supporting role for “specific applications and business units” (Wixom & Watson, 2010, p.15).

The metadata layer describes how the data is stored, the changes made to it and where it was taken from, thus corresponding to data about data (Ong et al., 2011; Palanivel, 2019). As shown in Figure 1, in the metadata layer we find the online analytical processing (OLAP), data mining metadata (the role of analyzing and extracting the most relevant information) and reporting metadata (for store reports names and reports description) (Ong et al., 2011).

According to Palanivel (2019) and Ong et al. (2011), the end user layer describes the tools used in the BI process to present information to its users, describing the level at which they are used. These tools are also capable of presenting information in different formats to different users, promoting the efficiency with which information is delivered (Ereth & Baars, 2020)

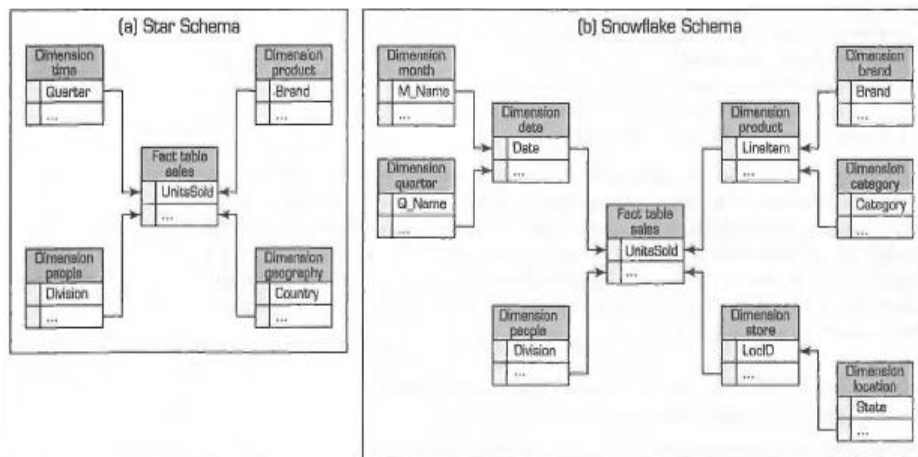
2.3. Dimensional modeling of the data

The data available on the DW must be represented using a dimensional model, where concepts such as fact, measure dimension and hierarchy are important to be understood (Golfarelli & Rizzi, 2018). The representation of data should be designed in a way that “not only accommodates but also boosts the processing of complex multidimensional queries”

(David et al., 2010, p.55), with star schema and snowflake schema being the solutions commonly used for this task (Golfarelli & Rizzi, 2018).

The star schema is the most used and simplest solution for dimensional modeling, as shown in the Figure 2 below, consisting of a fact table in the center and dimension tables around it (David et al., 2010). As Effendy et al. (2019) and Atre and Moss (2003) refers, a star schema represents the view of a business query, with the dimension tables all connected to the fact table. The fact tables contain foreign keys that will connect to the primary keys contained in dimension tables, having to have a correct correspondence to guarantee the integrity of the model (David et al., 2010; Effendy et al., 2019; Kimball & Ross, 2013).

Figure 2 - Star schema and snowflake schema



Source: David et al. (2010)

The fact table in the center stores the performance measures that result from the company's operations, with each row corresponding to a measurement event (Effendy et al., 2019; Kimball & Ross, 2013). Each row of the fact table must be at the same grain, such as measuring a line per product sold in a sale made by the company (Kimball & Ross, 2013). Dimension tables, on the other hand, contain information about the measurement performed in the fact table (David et al., 2010; Effendy et al., 2019) and “describe the “who, what, where, when, how, and why” associated with the event” (Kimball & Ross, 2013, p.13, emphasis in the original). Atre and Moss (2003) mention that these dimension tables have different characteristics from the fact table, having fewer rows but more columns and a one-to-many relationship with the fact table.

Regarding the snowflake schema, it is also used in the ETL process, but it consists of three types of tables, because in addition to the fact table and dimension tables, it also contains subdimension tables (Iqbal et al., 2019). In this type of schema, contrary to what happens in the star schema where the dimensions are denormalized and represented by a single table, the dimensions are normalized into multiple tables related to each other (David et al., 2010). The concept of hierarchy is thus introduced in the snowflake schema due to these subdimension tables and the splitting of dimensions (Iqbal et al., 2019).

2.4. Benefits and challenges in implementing a business intelligence solution

It only makes sense for a company to implement a BI system, if it brings greater benefits than the investment made. The literature suggests that implementing a BI system leads to an increase in efficiency and effectiveness, due to improvements implemented in management and operational processes (e.g., Alabaddi et al., 2020; Turan & Ugur, 2018; Williams & Williams, 2003). These benefits can be achieved because the technology allows users to quickly obtain and understand a high volume of complex information, essential for making fast, efficient decisions and enabling the achievement of business goals (Cardoso & Su, 2022; Hočevár & Jaklič, 2010).

Many authors, such as Alabaddi et al. (2020), Al-Aamr et al. (2021) and Ranjan (2005), argue that the most valuable assets of a company are the human resources followed by the information system. Thus, if the company has access to higher quality information, it will be able to improve its performance, making more efficient decisions (Alabaddi et al., 2020). Furthermore, a BI system can also improve the customer experience, “allowing for the timely and appropriate response to customer problems and priorities” (Ranjan, 2005, p.64).

Another benefit that a BI solution can bring is support in decision making at different management levels, namely the strategic, tactical, and operational levels (Aldossari & Mokhtar, 2020; Olszak & Ziemba, 2007). At a strategic level, Aldossari and Mokhtar (2020) state that a BI solution allows the definition of objectives and the pursuit of a strategy at a better level, and at a tactical level, it provides a basis for decision-making in the different teams of a company. Finally, at an operational level, a BI system is capable of analyzing the operations of the various departments, allowing the implementation of improvements capable of improving the business situation (Maharjan, 2019; Olszak & Ziemba, 2007).

In the Table 1 presented below and adapted from Atre and Moss (2003), it is possible to analyze the reasons behind the main benefits mentioned above. In the same way, Ritacco and Carver (2007) also develop a categorization of the benefits that should outweigh the costs of implementing the BI project. The three groups mentioned are: a reduction in the company's costs; an increase in revenues; and an improvement in the relationship with the customer and the relationship with the same.

Table 1 - Benefits of a BI system and reasons behind

Benefit	Due to
Revenue increase	<ul style="list-style-type: none"> • Identification of new markets and niches • More effective suggestive selling • Faster opportunity recognition • Faster time to market
Profit increase	<ul style="list-style-type: none"> • Better targeted promotional mailings • Early warning of declining markets • Identification of under-performing product lines or products • Identification of internal inefficiencies • More efficient merchandise management
Customer satisfaction	<ul style="list-style-type: none"> • Improved understanding of customer preferences • Improved customer-to-product matching • Up-selling to customers • Increased repeat business • Faster resolution of customer complaints
Savings increase	<ul style="list-style-type: none"> • Reduction in wasted or out-of-date merchandise • Reduction in requests for customized reporting
Market share gain	<ul style="list-style-type: none"> • Increased numbers of customers who defect from the competition • Much higher customer retention rate as compared with previous years and with the competition

Source: Atre and Moss (2003)

The implementation of a BI solution can also give rise to intangible benefits “such as improved communication throughout the enterprise, improved job satisfaction of empowered users, or sharing of intellectual capital” (Ritacco & Carver, 2007, p.19), capable of providing the company with a comparative advantage over its competitors (Turan & Ugur, 2018). However, the measurement of these intangible benefits is difficult. The areas in which the BI system is most applied are “general, sales and marketing analysis, planning and forecasting, financial consolidation, statutory reporting, budgeting, and profitability analysis” (Turban et al., 2010, p.12).

To understand the discrepancy between business needs and the ability of companies to meet these needs using BI solutions, it is necessary to understand the challenges that companies face. The obstacles are not only of a technological nature, leading the company to produce less value than expected, due to wrong behaviors in the face of problems that may arise during the process (Alabaddi et al., 2020; Boyer et al., 2010; Llave, 2018).

Merhi (2021) and Koronios and Yeoh (2010) state that for the BI system to be well implemented, it is important that stakeholders understand the critical success factors (CSF) to optimize resources and efforts. The identification of the CSFs that impact the implementation of BI systems is important, namely: a top management support; an organizational culture; the definition of clear objectives; the existence of a sustainable quality and quantity of data; an education and training of users, among others (Merhi, 2021). In his study, Koronios and Yeoh (2010) states that for BI initiatives to be able to produce a significant impact on the business, the company will have to follow a clear business-driven objective.

According to Miller et al. (2006), the challenges that may arise when implementing a BI system can be classified into six categories, namely: data challenges; technology challenges; process challenges; strategy challenges; users challenges; cultural challenges. Challenges such as the difficulty in defining business goals or a strategy, the possibility of limited funding or a weak organizational structure, lack of expertise, and the lack of metrics can also play an important role in the success of the process (Boyer et al., 2010; Hasan et al., 2016).

Incorrect data management is the main and most expensive cause of failure in BI implementation, requiring a lot of time and resources to obtain it, with no guarantee that they are accurate or valid, being unreliable to trust and use this type of information (Bräutigam et al., 2006; Gadekar et al., 2020; Hasan et al., 2016). In the book written by Moss and Atre (2003), the authors define a set of questions that must be asked to understand the risk associated with the integration of various components and of data. This analysis makes it possible to perceive the consistency of the data, which are later stored in various formats and various databases, and there may be difficulties in their accessibility or storage (Bräutigam et al., 2006).

The implementation of a BI system also promotes the use of heterogeneous technological tools and infrastructures, and there may be difficulties in the articulation

between them, which will result in difficulties in sharing information and in an increase in costs (Bräutigam et al., 2006; Turan & Ugur, 2018). Thus, a constant analysis of the technologies in use by the company is necessary, analyzing their maturity and their compatibility within an operating system, trying to promote improvements in the process (Atre & Moss, 2003).

Miller et al. (2006) argues that BI is not just a software product, but a whole process, capable of being measured, altered, and documented, being able to adapt to changes in business needs. For the implementation of these processes to be successful, it is necessary that the human capital of companies be able to understand the entire process and to meet the constantly changing demands, being essential to assess “the project team staff’s skills, attitudes, and commitment levels” (Moss & Atre, 2003, p.69).

Companies often find it difficult to align BI initiatives with organizational strategy, as the heterogeneity of groups within the company leads to the need for different BI solutions. Thus, it is necessary for the company not only to develop a BI strategy, but also to ensure that it is executed effectively (Ain et al., 2019; Atre & Moss, 2003; Bräutigam et al., 2006; Gadekar et al., 2020).

Authors such as Hasan et al. (2016), Miller et al. (2006) and Ain et al. (2019) also defend the existence of challenges at the user level, because as BI technologies are in the know-how, their acceptance may be a problem for companies that intend to implement them. This situation may be even more difficult to resolve, when “the management is lacking in providing the training and support for BI solutions” (Hasan et al., 2016, p.176) which will exacerbate the lack of knowledge and the absence of the technical skills (Ain et al., 2019). Finally, there are cultural challenges that the company can face, given that it is necessary for managers to understand that each organization is unique, and it is necessary to understand the culture of each one of them and how it can be used to extract the maximum benefit (Bräutigam et al., 2006; Foshay & Kuziemy, 2014; Merhi, 2021; Turan & Ugur, 2018). For example, Foshay and Kuziemy (2014) analyzed the most critical factors that should be addressed by healthcare organizations that are in the early stages of BI system implementation. In addition, the authors develop a framework for defining and prioritizing decision-support information needs in the context of healthcare-specific processes. They found that strong management support, the right skill sets, and an information-oriented culture are key implementation considerations.

Razmi and Sangari (2015) also developed an empirical study with several manufacturers, where they mentioned the potential of BI to improve the supply chain and particularities of the implementation of a BI solution. In this study, the authors found that there is a need for a strong BI culture to make the most of the investment made to implement a BI solution. With this, the article suggests that this decision to adopt or not a BI solution is dependent on an analysis of its costs and benefits and on the alert requirements for existing changes in the supply chain and in the business environment.

2.5. The monitoring of the business performance

Monitoring the performance of a company has become increasingly fundamental in the current business scenario, due to the increase in rivalry between companies and the constant change in it (Carlucci, 2010). According to Franceschini et al. (2019), the implementation of a performance measure system (PMS) is advisable because it allows focusing on the strategic plan of a company, its objectives and performance. In addition, it will also be possible to improve the company's internal and external communication, as well as provide a justification for the programs and their costs, being fundamental in the decision-making process (Franceschini et al., 2019).

This task of measuring the activity of a company is not simple, it is essential to identify the “correct” indicators for the adequate representation of the process (Franceschini et al., 2019, emphasis added). An indicator is defined by Parmenter (2019) as a metric which quantifies a specific feature of a control object or its surroundings, normally being a combination of several measurement data through a calculation rule.

A PMS is thus constituted by metrics, which represent a set of measurement indicators, and by methods, which correspond to the approaches used to obtain the metrics (Agostino & Sidorova, 2016). These performance metrics are used by executives to “define and communicate strategic objectives tailored to every individual and role in the organization” (Eckerson, 2009, p.4), in order to help the organization achieve its goals.

The quality of a company's PMS depends on the indicators used, with the literature gathering characteristics that will define an indicator as being a useful indicator in view of the organization's needs (Carlucci, 2010). Thus, Kerzner (2017) refers to some basic characteristics that a metric must have in order to play an important role in measuring

performance, such as being able to provide useful information, being able to be accurately measured to reflect the status of the project or have a focus towards a target. In addition, the indicator must have a purpose, it must be able to support the proactive management of the company, helping to assess the probability of successful decisions, and it must also be accepted as a useful tool for this decision-making (Kerzner, 2017).

Franceschini et al. (2019) mentions other characteristics that an indicator must have to be able to profile a good indicator, such as simplicity so that it is easily understood and used, not including redundant indicators, not encouraging counter-productive actions and be consistent with the long-term goals of an organization. Characteristics such as having an economic impact, being able to cover important dimensions of the process, being consistent with objectives or providing the right level of detail (not too much information and not less than necessary), are also important in defining a good indicator (Franceschini et al., 2019).

In addition to this, authors like Kerzner (2017), Eckerson (2009) and Parmenter, (2019), also focus on presenting the characteristics that define an efficient KPI, some of which are similar to those presented above. Domínguez et al. (2019) defines a KPI as a measure of an aspect of organizational performance, being critical to the success of the company today and in the future. An effective KPI is characterized by being simple, drillable into detail, correlated, balanced, and aligned in a way that an indicator does not unintentionally undermine the other (Eckerson, 2009). Parmenter (2019) adds some more features, arguing that a KPI should be non-financial, regularly monitored, have a significant impact and be able to be tied to a team to ascertain responsibilities. Features such as the indicator being actionable, i.e. users being able to use the indicator to improve performance before it is too late, and the indicator being referenceable, i.e. users being able to understand the origins of the metric usage are also important (Kerzner, 2017).

Although performance measurement is a fundamental instrument to guarantee the good performance of a company, it is important to understand its limitations and what problems may arise. Thus, Franceschini et al. (2019) argue that bad results coming from performance measurement are not always a sign of poor execution of the measurement.

In addition, the dimensional model represented is not always an exact copy of what happens in reality, and the metrics used are the result of a high set of factors, which makes it difficult to decide on the measures to adopt (Franceschini et al., 2019; Kerzner, 2017).

There are also situations in which the indicators themselves can be misused, leading to: different interpretations, the use of irrelevant indicators, goal displacement, among others (Franceschini et al., 2019).

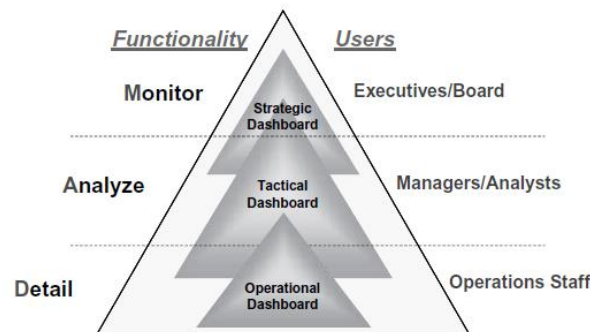
There are also some myths related to performance measures that are important to be noticed to obtain better results (Kerzner, 2017; Parmenter, 2019). For example, Kerzner (2017) argues that there is a myth that dashboard users can always and almost immediately understand what they are viewing, and that the dashboards are easily made. It is also important to mention that there may be situations in which the number of metrics used is too high (Kerzner, 2017). In turn, Parmenter (2019) states that not always a measure will lead to an improvement in the company's performance, and it is also important to realize that not all measures will work in all organizations at any time, being necessary to have a measurement context. It is also important to realize that not all performance measures can be considered KPIs. In addition, Parmenter (2019) also mentions that it is a myth that we can understand what will be considered a good performance before the start of the measurement period, and it is difficult to establish the target. Finally, it is argued that KPIs are not financial indicators, as they are a monetary quantification of an activity performed (Parmenter, 2019).

A dashboard is a very useful tool to support a company's decision-making, being characterized by Vieira et al. (2018) as an instrument capable of systematically monitoring business information to support management, also enabling a simple visualization of it. Dashboards are used to improve performance, make better strategic decisions, assess the effectiveness of implemented processes, communicate company values, among other functions (Alhamadi, 2020). This quick monitoring is possible because the performance metrics are visually displayed on a single screen, to convey insights to those who are viewing the dashboard and help in decision making (Vieira et al., 2018). The creation of a dashboard is composed of three fundamental steps, according to Vieira et al. (2018), namely:

- preparation phase, where the project objectives are identified, aligned with the company's strategy and identification of relevant information and data status;
- design phase, where indicators and the layout of the dashboard are defined;
- phase of monitoring operationalization, where it is defined who has access to the report or the frequency of updating the data.

Given the different needs of different groups of people within an organization, there is a need to create different dashboards, and the literature has identified three types of dashboards: strategic, tactical, and operational (Eckerson, 2009, 2011), each of which is associated to a group of people within an organization, as shown in Figure 3.

Figure 3 - Types of performance dashboards



Source: Ong et. al (2011)

Strategic dashboards are intended to help senior executives execute strategies, monitor performance and lead to the implementation of better behaviors, consisting of KPI that measure the company's past performance (Eckerson, 2009). The focus of this type of dashboard is to achieve future objectives and strategic goals of the company, with the need to establish goals for each metric, usually based on a standard benchmark (the company's performance in the past or a better performance of a competitor company) (Eckerson, 2011).

Eckerson (2009) states that tactical dashboards aim to help mid-level or departmental managers to improve the performance of the team under their supervision. This type of dashboard is more focused on analysis, being based on time series or comparisons between categories and refreshed daily or weekly to “display the most current data that exists in the data warehouse” (Eckerson, 2011). The purpose of creating these dashboards is for managers and analysts to be able to identify problems and make corrections to ensure short- and long-term goals (Eckerson, 2009).

Finally, operational dashboards aim to control operational activity, showing an image of the current moment and ensuring that processes meet the criteria of productivity, quality and efficiency (Eckerson, 2011). The KPIs used in the elaboration of these dashboards result

from operational metrics that can generate higher-level KPIs (Eckerson, 2009). Eckerson (2011) says that this type of dashboard is therefore more action oriented, allowing the user to solve problems at an early stage and explore opportunities before they disappear.

As mentioned by Figueiras (2014), when creating dashboards it is important to encourage the use of narrative elements in the visualizations, as they help the user to be able to perform a more structured interpretation. There is a consensus that storytelling in the data visualization makes the project more interesting and the analysis more pleasant, and the storytelling is influenced by the interactivity of the visualizations (Frazier et al., 2012). Thus, a greater user interactivity with the visualization will reduce the control of whoever creates the dashboard over how the story is told.

3. Methodology

Research methodology is the way in which the investigation will proceed to be able to solve the research problem (Arisha & Ragab, 2018). According to Yin (2018), in the context of social sciences, research can be developed in a variety of ways, including experiments, surveys, archival analyses, historical analysis and the case study. After knowing the different methodologies that can be adopted to develop an investigation, it is necessary to choose the right one to achieve the research objective and ensure the credibility of the conclusions presented (Arisha & Ragab, 2018).

To find a solution to respond to the need to gather information centrally to allow the CEO to improve decision making, it was important to understand the best methodology to follow. Thus, given the opportunity that arose during the internship of developing a BI solution, the method that can better explore all the processes necessary to solve the problem is the case study research. The choice of this research method is based on the need to describe all the processes carried out during the development of the BI solution. With this, we intend to answer the problem of the study, analyzing a practical case, describing its particularities and all the challenges encountered along the way.

That said, the problem presented by HR Connect and which led to the development of this report was the lack of quick collection of information necessary for the CEO to understand the current situation of the company. So, the objective of the report was to understand how it would be possible to respond to the problem presented by the company.

3.1. The case study method

The case study corresponds to an empirical research method, where an intensive and detailed analysis is carried out of a contemporary phenomenon within its real-life context, which may be an event, organization, or situation (Schoch, 2020; Yin, 2018). The objective of carrying out a case study is to describe the set of actions and decisions taken, explaining why they were taken, how they were implemented and their results (Ebneyamini & Sadeghi Moghadam, 2018). Authors such as Arisha and Ragab (2018) and Ebneyamini and Sadeghi Moghadam (2018) claim that case study research is one of the most powerful research

methods, allowing researchers to achieve practical and theoretical goals through the collection and analysis of qualitative and quantitative data from different sources.

There is a need to reflect on the design of the case study, to have a plan considering the practical aspects related to its development, and the characteristics of the case are defined by the research questions and the theoretical framework that underlies it (Scapens, 2004). One of the important advantages of the case study research referred to by Ebneyamini and Sadeghi Moghadam (2018) is the possibility of obtaining a holistic view of the process carried out. This means that the methods that are described in detail in the study allow for an analysis of various issues related to the problem of the study, examining them in relation to each other and visualizing whole the process.

According to Yin (2018), different research methods can be used to fulfill three purposes, namely exploratory, explanatory, and descriptive studies. In the same way, there may be exploratory, explanatory, or descriptive case studies, having had the need to understand the purpose that was intended to fulfill this project. Considering the initial problem of the project, as well as the objectives that are intended to be achieved with it and the particularities resulting from the internship carried out and the project presented, it was concluded that the most appropriate research method for the report would be the descriptive case study. It is also important to note that the study developed will be a single case study, since only a concrete situation will be explored in a real context, in a company that will be the subject of study (Ebneyamini & Sadeghi Moghadam, 2018).

3.2. Case study development

Scapens (2004) refers to the various steps that an investigator must carry out to implement an efficient methodology in his case study, namely: preparation, collecting evidence, assessing evidence and identification and explanation of patterns. Although these steps are organized in a logical way, it is important to emphasize that the case study research is complex and interactive, and there is a need for complementarity between the different steps to provide a complete and correct analysis.

Thus, in the preparation of this report, these steps were followed, being described in this chapter the steps of preparation and collection of evidence, which are the basis for the development of the case study project.

3.2.1 Preparation

The preparation phase of a case study research involves defining the research question, as well as the general and specific objectives of the study that will be carried out (Ebneyamini & Sadeghi Moghadam, 2018). Scapens (2004) argues that this stage of the elaboration of the case study research should be accompanied by a literature review that will justify the elaboration of the case study.

Conducting a literature review is essential to define the research problem and to obtain a precise idea regarding the current state of knowledge on the research topic. Thus, through the literature review carried out in chapter two, it was possible to clarify relevant concepts for the development of this project.

To carry out this preparation of the case study analysis, meetings were held between the faculty supervisor and the supervisor at DevScope, to understand the best solution to develop a viable and relevant study, not only for this report but also for the company. In one of these meetings, the possibility of developing a BI project for one of DevScope's customers, who wanted to remain anonymous, was addressed. To comply with this DevScope customer requirement, the fictitious name of "HR Connect" was given to the company, and a characterization of it was made throughout chapter four. Thus, it was agreed that the development of this project would be able to become a relevant case study research to answer the research problem. The target of the case study research was thus HR Connect, having carried out a field work with the support of the literature review carried out, to be able to implement the BI solution.

3.2.2 Evidence gathering

The evidence gathering phase is essential to ensure the existence of a solid and relevant database, to be able to obtain consistent conclusions after the case study research (Yin, 2018). There are three principles of data collection referred to by Ebneyamini and Sadeghi Moghadam (2018) to make this process more efficient, namely: the use of multiple data sources, the creation of a database for the case study and the maintenance of a chain of evidence.

The use of multiple sources is useful as it helps to minimize the problem that the boundaries between phenomenon and context are not always clear, and sources of evidence can include documentation, archival records, interviews, direct observation, participant observation and physical artifacts (Schoch, 2020). The research questions posed at the beginning of the study will direct the data that need to be collected, determining the type of questions to ask in the interviews, what to look for, what documents to review and what artifacts to examine.

During the work developed, there was an attempt to collect evidence from different sources, to guarantee a higher quality of the case study research. Thus, the evidence gathering work went through a desk review of evidence provided by HR Connect, two interviews with the company's CEO and direct observation and participation during the process. In addition to these evidence gathering techniques, there was also the development of a questionnaire survey with the aim of evaluating the BI solution and which was delivered to a sample of DevScope workers in the BI area. In this questionnaire, a Likert scale was used, in which the respondent assigns a rating between 1 and 5 to a set of statements in relation to the final BI solution presented.

The collection of evidence through document analysis involved analyzing the set of Excel files provided by HR Connect, to be able to create a database for the later development of the BI project. In addition, documents provided by the company were also analyzed to characterize the company, obtaining information about the areas of activity, the corporate profile and its history and mission.

Although all BI projects have planning processes, roles and underlying concepts that are similar, there are not exactly like solutions, and it is important to understand the customer's needs. Thus, it is important that organization, planning and collaboration between stakeholders exists, so that the BI project can succeed in the long term. The interviews with the CEO of HR Connect are justified by this need, and two interviews were carried out at different stages of the process.

Regarding the interviews carried out with the CEO of HR Connect, at an early stage this was intended to present the company, as well as an explanation of the need to develop a BI solution (See Appendix A). In this interview, a survey of the HR Connect requirements for the BI solution was also carried out, to understand the characteristics that the project

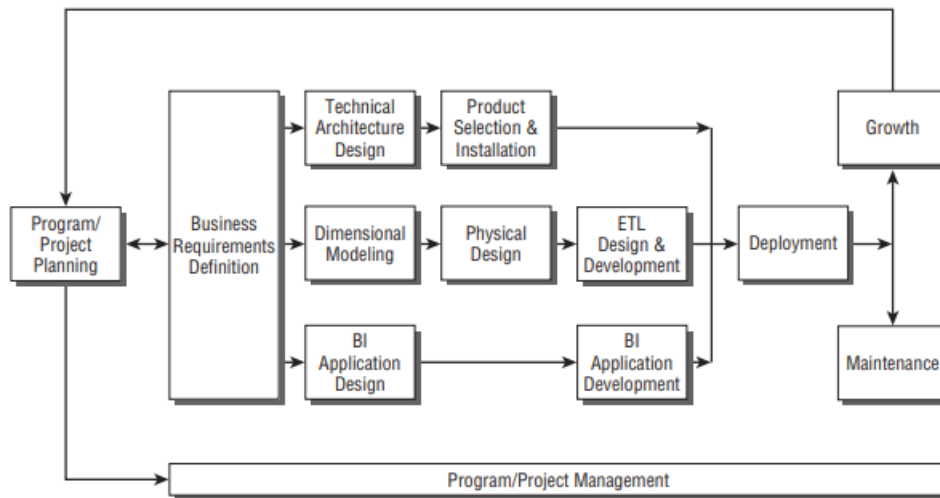
should have. In this way, it was intended to follow the recommendations presented by Yin (2018) of being able to ask "why" and "how" questions, trying to understand what makes the company look for a BI solution and how it can be implemented.

During the development of the solution, there were also several informal contacts, to answer questions that arose, such as the clarification of a process or whether the visualization of a certain indicator would be appropriate. After the development of the BI solution, another interview was carried out with the CEO of HR Connect, to assess its usability, as well as his satisfaction with the project developed (See Appendix C). The transcription of the questions asked, and the answers obtained was carried out, to be able to incorporate this relevant information in the development of the report.

In the development of the activities necessary for the implementation of the solution, it was also necessary to resort to the use of different software, as will be mentioned in the chapter describing the implementation. Thus, software such as Power BI Desktop, Power BI Service, data analysis expressions (DAX) studio or Excel were fundamental for the development of this project.

The roadmap of activities to be developed in the realization of a BI solution mentioned above was fundamental to the process. The lifecycle roadmap of a BI system was introduced by Kimball and Ross in 1998. This roadmap is composed by a set of activities that are necessary to carry out and “illustrates task sequence, dependency, and concurrency” (Kimball & Ross, 2013, p.404), as it can be seen in the Figure 4.

Figure 4 – Lifecycle roadmap of a BI system



Source: Kimball and Ross (2013)

In the first activity presented by the authors, the project planning is carried out, an assessment of the level of the company being studied and its ability to support a BI system is carried out. After that, it will be necessary to define the business requirements and customer needs that must be satisfied. This information is obtained through a dialogue with the company’s managers and other users, through interviews, or through the analysis of relevant documents.

After these activities are completed, the diagram presents three tracks in parallel that are followed so that the solution can be deployed. The track at the top shows that a technical architecture design must be carried out to establish an integration structure for the various technologies used. After evaluating the design, it is then necessary to select the products to be purchased in view of the objective to be achieved.

The central path focuses on data-related activities, the first being the transformation of customer requirements into a dimensional model, which is later transformed into a physical structure. After these two activities, the ETL system is developed, allowing the data to be modeled according to the needs and loaded to be visualized.

The third task path presented corresponds to the design and development of BI applications, having to perform parameter-driven templates and analyzes to transmit the relevant information to the users.

After all these activities, it is possible to deploy the BI solution, there is no end of the cycle here because the maintenance of the solution is continuous and necessary for it to remain healthy. In addition, the growth of the solution often leads to subsequent projects, thus returning to the beginning of the lifecycle.

4. Characterization of HR Connect

In this chapter we intend to describe the company that is being the subject of the case study research and that was renamed to “HR Connect”. Thus, reference will be made to important characteristics of the company, such as the area in which it operates, the services provided by it, the number of employees, its turnover, among others. Knowing the company in depth is one of the steps to be followed to guarantee the implementation of the BI solution, since it will only be possible to obtain a correct view of the business if there is a full understanding of its characteristics. This characterization will also allow a better understanding of the work developed throughout the report.

HR connect is a leading company in human resources management, offering its services worldwide. The company stands out for its services in the areas of temporary work, recruitment, consulting, and outsourcing, allowing 350,000 people to find employment in 2021. Founded in 1946, HR Connect has its corporate headquarters in Troy, Michigan, where it employs around 1,000 employees, and employs 7,000 people in its global network. The company strives to provide the world’s best workforce solutions, reaching in the year 2021 a revenue level of 4.9 billion dollars.

The company prioritizes relationships over transactions, valuing teamwork and presenting a set of values that shape its way of operating. These values are the creation of strong relationships, the treatment with respect and integrity of the customer, employee, and supplier, always looking for opportunities to innovate, address customer and candidate problems urgently and be responsible for the actions taken. HR Connect devotes its time and resources to providing the client with valuable work experiences and professional development.

In carrying out this project, there was a focus on the company’s activities developed in the United States and Canada, even though it is present in many countries. Thus, the way the company develops its activities will be explored, trying to provide an image of it.

5. Implementation of a BI solution in HR Connect

In this chapter, we intend to describe all the activities carried out to be able to implement the BI solution. Thus, a detailed analysis is carried out in a chronological order of all the stages, with the objective of elaborating a path for a correct implementation. Thus, it starts with an elaboration of the project framework, offering an overview of the developed project. After that, the steps and technologies used will be described, trying to make a connection with the literature review made to justify the developed processes. Processes such as data modeling, the choice and creation of indicators, or the elaboration of the necessary dashboards will be described, providing a view of the particularities of the project. In addition, interactions with HR Connect will also be described, to understand the relationship with the customer and what kind of questions should be asked, both during pre-implementation and post-implementation. The first interview carried out served to understand the problem presented by HR Connect, as well as to survey its needs. The second interview, carried out after the implementation of the solution, aimed to evaluate the BI solution, realizing improvements to be made and whether it satisfied the request made.

5.1. Framework of the project

The main objective of the Power BI project developed is that it can provide a global vision of the company. Thus, it is expected that this information gathering will allow the CEO to obtain insights in a faster way. To develop the project, it was necessary to understand which indicators to create to provide an image of the global activity of the client's company. In this way, there is a need to carry out a detailed description of all the activities carried out so that it is possible to respond to the research problem related to the development of the BI solution.

5.2. HR Connect requirements and needs

To comply with the methodology mentioned by Kimball and Ross (2013), the gathering of the business requirements and customer needs related to the BI solution was one of the first activities carried out, through an interview with the CEO of HR Connect. These questions were asked after the presentation of the company was made, having a

perception of the characteristics of the company, such as the activities that it develops, the volume of business or the number of employees.

In this first interview, the objective was to understand why the company resorted to a BI solution, as well as the problems they expected the solution to be able to solve. Thus, it was noticeable that the client's main problem was the need for a simple process of information gathering for the CEO. In this way, he should be able to understand the current situation of the company. So, the objective was to develop a set of reports and dashboards so that an executive or the company's CEO would be able to understand in a matter of minutes what the current situation of the company is and whether it is on the right path to achieve the business goals. In this way, the company intends to have a 360 view of its business, allowing a quick understanding of the areas in which they must act, and at an operational level, being “able to streamline meetings between the President and those responsible for each department of the company” (Interview 1).

The client stated that the main reason to implement a BI solution would be to streamline the decision-making process, as well as the existence of an information source in which the data is properly consolidated. With this, it is intended that “the solution should save time, money and resources” (Interview 1), since the collection, treatment and interpretation of data is no longer performed by an analyst. This leads this analyst to focus only on analyzing the data returned by the BI system and proposing new decisions for the business based on the information.

In the first interview with the client, there was an attempt to understand how the company maintained its database. It was replied that the company was finishing the migration of its analytical database, which went from being weekly, to a new data warehouse where data is updated daily. Furthermore, it was noticeable that HR Connect was still “in a transition phase to a modern BI system, and the BI culture was based on the existence of hundreds of reports created according to each team/individual” (Interview 1). One of the goals of the solution was thus to modernize this BI culture, allowing for a streamlining of processes and the creation of a system in which the information was consolidated and was adopted in a common way by the various teams of the company.

Although DevScope developed a BI solution for HR Connect, it was aimed only at operational level users. Thus, the opportunity arose to develop this project, carrying out a

general analysis of the different areas of the company to assist the CEO. Some examples of indicators that were already proposed by DevScope were the number of meetings that each recruiter of the company held, the total number of orders made each month by the company's customers, among others.

In this way, there was also an attempt to understand in this first interview which were the different areas of HR Connect, so that it was possible to convey a 365 image of the business. After understanding the different areas of HR Connect, it was possible to define which were the best indicators to summarize the current state of the business to the CEO. In addition, it was necessary to understand the frequency with which the company collects its business data, to understand the time period of the report, and also what questions HR Connect wanted to see answered through the BI solution.

5.3. Planning the Power BI project

As DevScope is one of Microsoft's partners, the company adopted in 2013 the Power BI for the development of BI solutions. In line with the company's way of operating, this project was developed by using this software. It comprises three components: the Power BI Desktop, where the BI solution was developed; the Power BI Service, for sharing reports; and the Power BI mobile app, for viewing reports on mobile devices.

Power BI's main objective is to be able to support business decisions, using structured, periodically updated, and available information (Microsoft, 2019). In addition, this software is characterized by Nogueira (2018), as a BI system capable of collecting and joining data from various sources, transforming them into useful information for decision making, using different types of visualizations, such as bar and line graphs, tables, or cards. One of the great capabilities of Power BI is being able to analyze millions of records present in the databases, obtaining answers in a few minutes that without the software would take hours and avoiding problems that could happen if we only used spreadsheets (Nogueira, 2018).

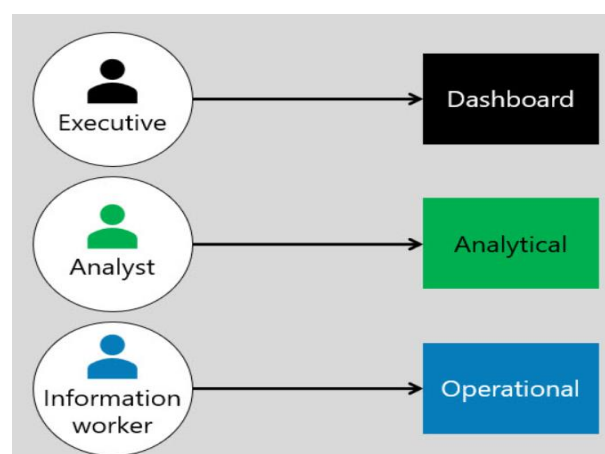
After understanding the customer's requirements, it is then necessary to ask additional questions to be able to plan the BI project and try to face the challenges that may appear when carrying out the necessary tasks. The questions asked to HR Connect are related to several stages of the project, namely data sources, security and access issues, and data

refresh. Also, the time period of the analysis how often reports have to be submitted, including the core KPIs for HR Connect, the existence of previous reports or the device on which the reports will be viewed. These questions were asked to the CEO of HR Connect during the development of the project, through emails that allowed a better result of the developed solution.

Whenever a BI project is started, it is necessary to ask these questions to understand its goals and define the requirements in terms of the target audience, the type of report that will be created and the interface or experience requirements for the user. The identification of the target audience is therefore crucial to be able to build a report that covers the user's needs, and there are three main types of target audience. These three types are the executive, the analyst, and the information worker. An executive is someone who will have to make decisions that encompass the entire company and with a focus on the medium and long term. The analyst, on the other hand, is more focused on developing or improving company processes and implementing changes to make them more efficient. Finally, the information worker interprets the data and makes decisions at the operational level daily, an example of which is a stock manager.

Depending on the target audience, there will be different types of reports that can satisfy this objective. These three types of reports are the dashboard, the analytical report, and the operational report, and as we see in Figure 5, for each type of target audience, there is a type of report that is more advisable to create.

Figure 5 - Types of target audience and reports



Source: Microsoft Learn

In this case, in which the project's target audience is a company executive, such as a CEO, the report developed was a dashboard, to provide a generalized view of the company. For this, it is important that the visuals contained in the dashboard allow the user to be able to answer questions such as: "How is the company developing" or "Are we on the right track to achieve our goals?". The focus of a dashboard is to allow the user to interpret the story as quickly as possible, through visuals that are self-explanatory, focused and clearly labeled. Furthermore, it is intended that user interactions are limited by insights that are highly curated toward the audience and that the dashboard clearly and directly communicates the meaning behind the data, to reduce the number of misinterpretations. Thus, a strategic dashboard was developed, where, as mentioned by Ong et al. (2011), the objective of the dashboard is to monitor the entire activity of the company, allowing executives/board an improvement in decision making.

5.4. ETL process in Power Query Editor

Following the architectures defined by Ereth and Baars (2020), Palanivel (2019) and Watson and Wixom (2010), the next step in the development of the solution was analyze the data sources of the project to carry out the ETL process next, making use of the Power BI Desktop capabilities to successfully carry out this step. Power BI Desktop is able to connect to different types of data sources, namely local databases, Excel worksheets, data on cloud services, among others. It is also possible to carry out the necessary transformations of the data, so that they are loaded correctly.

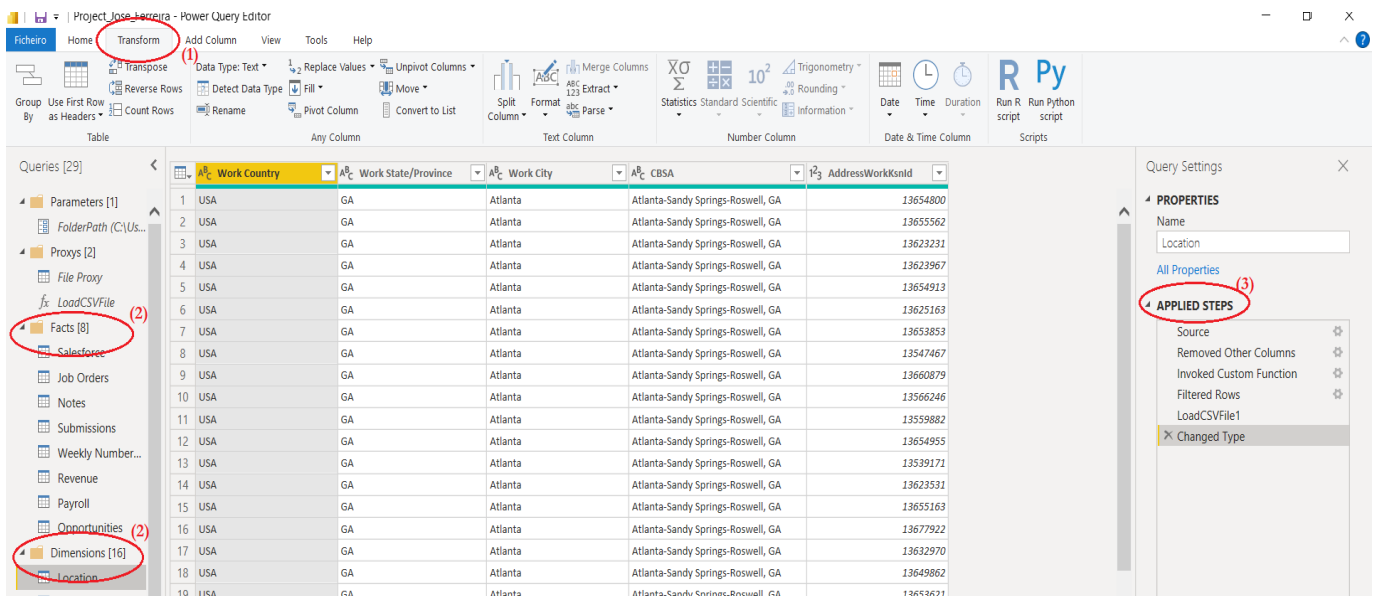
In this project, the company contained all the data of its activity in Excel worksheets, and through Power BI Desktop, it was possible to aggregate all the data and organize them, to create a dimensional model for the company. This set of spreadsheets contained information from all different areas of the company, such as information about orders placed by customers, information about revenues, personal information about the customers and company employees, among others. Only having all this information about the company's activity is it possible to build a report that conveys an overview of the company.

After collecting the data and loading it into Power BI, it may need to be changed as it may not be well structured. To solve this problem, the software contains the Power Query Editor, capable of structuring and transforming the imported data to ensure that it is suitable

to use in reports. The Power Query Editor allows the user to perform actions such as change data types, removing blank rows, renaming columns or tables, setting the first row as headers, and much more. One of the Power Query Editor's potentials is to document each transformation performed, allowing you to visualize all the steps performed in the data transformation and facilitating the entire process.

As can be seen in Figure 6 below, the Power Query layout has several options to facilitate the ETL process, and in the top navigation menu (1), it is possible to obtain the database contained in the Excel worksheets, perform data transformations, or add new columns to tables. In addition, we can organize on the left side (2) all the tables that have been loaded into Power Query, making it possible to create groups to better organize the database. Another of the potential of the software already mentioned is the ability to record all the steps applied in the ETL process, being possible to see on the right side (3) all the steps and transformations carried out.

Figure 6 - Power query capabilities



Source: Power BI Desktop

A good practical example of the importance of this data modeling was verified when it was necessary to transform the data used in the model in view of the requirements presented by HR Connect. In view of the database provided by the latter, it was possible to perceive that the data contained in the tables of orders placed by customers (Job Orders) and

the data on the company's revenues were fragmented in the years prior to 2021. In this way, the model of the data was made, applying a filter so that Power BI Desktop would only use the records contained in these two tables that were later than 31 December, 2020. It thus allows a better analysis of the company's situation, since if fragmented data were used, the conclusions could not be so precise. This filter also allows for better software performance as it will not be loaded with data that is not interesting for analysis.

5.5. Dimensional modeling of the data warehouse

To ensure a better performance in obtaining information about the company, there is a need to build a dimensional model for the development of a DW, as referenced by Golfarelli and Rizzi (2018). In this way, it is necessary to look again at the customer's requirements to build the model, which is the support for the company's decision making.

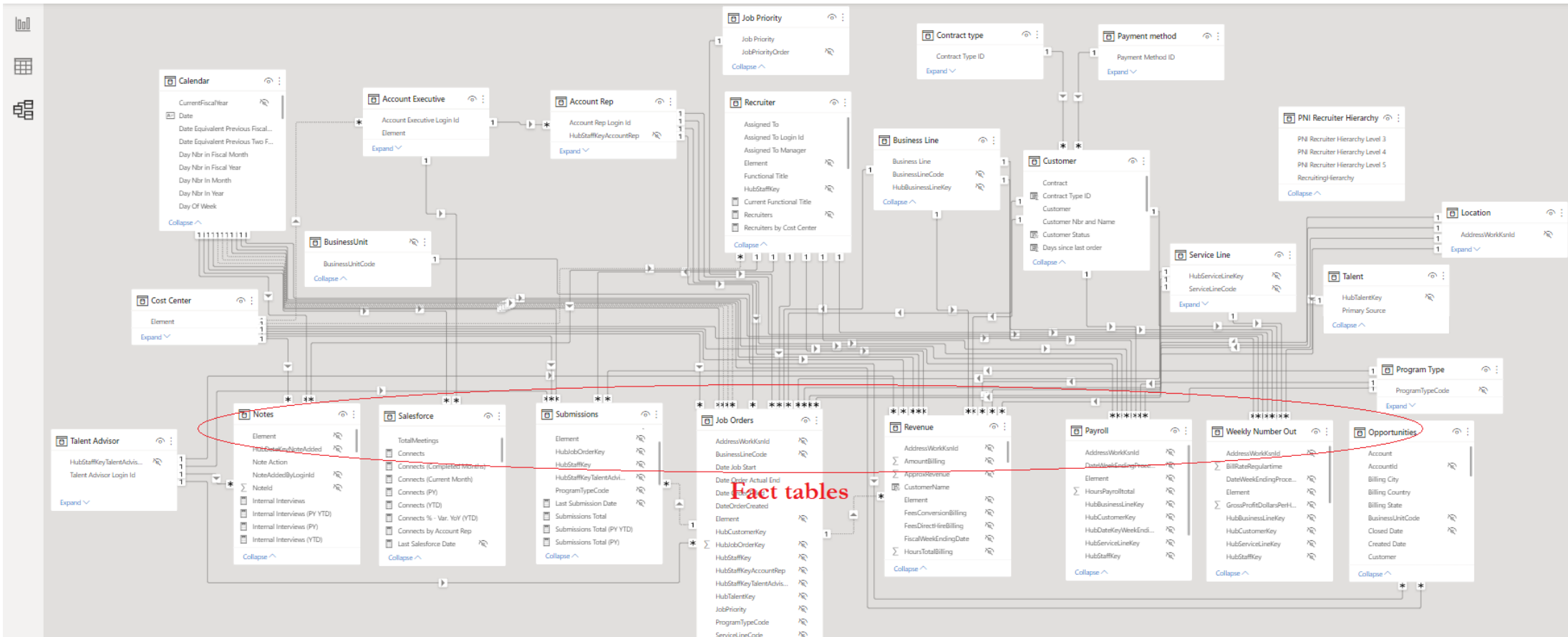
The high volume of information related to the client's business requires a complex dimensional model of the database, and it is important to be able to understand the entire model to collect the best insights. Following what is argued by David et al. (2010), it is necessary to perform dimensional modeling to optimize the data storage in the data warehouse for faster retrieval of data. Once we have this dimensional model, it will be possible to carry out all the actions intended to analyze the company, such as reading the data, summarize and analyze all the numerical information contained in the DW.

Before building the schema, there is a need to go through some steps, to guarantee its effectiveness. The first step was to identify which business process the DW should cover, depending on the quality of the data available. Next, it is necessary to understand the granularity of the model, that is, the level of detail for the business problem, identifying the lowest level of information for any table in the data warehouse. For example, if a table like the "Job Orders" table contains records for every day, it will have a daily granularity. After that, we must look at all the tables to see which ones correspond to dimension tables, such as data, stores, inventory, clients, and the tables that correspond to fact tables, being most of the fact table rows numerical values like price or cost per unit.

Finally, and after all these steps, it was possible to implement the dimensional model, through the construction of a schema, which is an arrangement of tables to structure the database. Due to the complexity of the dimensional model, there was a need to find

additional knowledge about a new type of schema to organize the data, in addition to the star schema and snowflake schema referred to by Golfarelli and Rizzi (2018). As it was mentioned before, the star schema consists of a fact table and several dimension tables, and the snowflake schema consists of a fact table, several dimension tables and sub dimension tables. Since for this solution, there was not only one fact table but eight, as we can see in Figure 7, there was a need to acquire knowledge about the fact constellation.

Figure 7 - Dimensional modelling of the data



Source: Power BI Desktop

The fact constellation is thus a schema used for representing a multidimensional model, being a collection of multiple fact tables that have some dimension tables in common. It can be seen as a set of several star schemas, being one of the most widely used schema for DW designing when the system is complex, and it is also known as Galaxy schema. Although a Fact Constellation provides a flexible schema, allowing you to build a model that contains a large amount of information about the business, it has the disadvantage of being much more complex and hence, harder to implement and maintain.

5.6. Indicators to measure the company's activity

After having complete information about the client's requirements, there is a need to understand the database provided. When this process of understanding the database is completed, it is possible to move on to the process of model the data to ensure correct processing. Then the data is ready to create measures to present the company's performance indicators in the report's visuals. It is important to know which indicators can best represent the company's global activity, being essential to understand in the first interview with HR Connect how they evaluate the company's success. Furthermore, it was important to understand which indicators are used in other BI solutions implemented and present in the literature review, to understand if the same indicators are suitable for this solution. The choice of indicators is intended to provide an image of the company's performance in the past and present, and a forecast of the performance in the future.

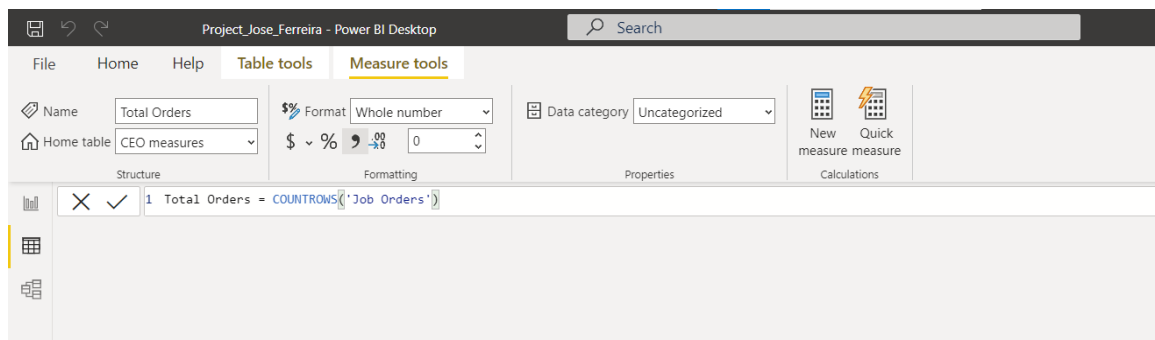
With the goal of define the best set of indicators to use to measure the company's activity, the following question was asked in the first interview with the CEO of HR Connect: "How does the company measure its own success and what are the key indicators for the measurement of your success?" (Interview 1). The CEO answered that "the success of the company is measured mainly based on total profit, profit margin, customer retention and satisfaction and also the performance and satisfaction of the company's teams" (Interview 1).

To create these necessary measures for the report, Power BI Desktop contains an important tool for this action to be carried out successfully. So, I was introduced to DAX, which is a formula expression language used not only in Power BI, but also in analysis services or Microsoft Excel's Power Pivot. DAX is a collection of various functions,

operators, and constants, used in a formula or expression to calculate or return a single value or a set of values. Thus, having some knowledge of the formulas used in Excel, it was easier to understand the fundamentals of using DAX and to create efficient formulas to extract the maximum information from the database.

These DAX formulas, in addition to being used in measurements, are also used in calculated columns, calculated tables, or in row-level security. These measures were used in reports like this one, allowing for the combination or filtering of the data in the model. These measurements were created using the DAX formula bar, as can be seen in Figure 8 below.

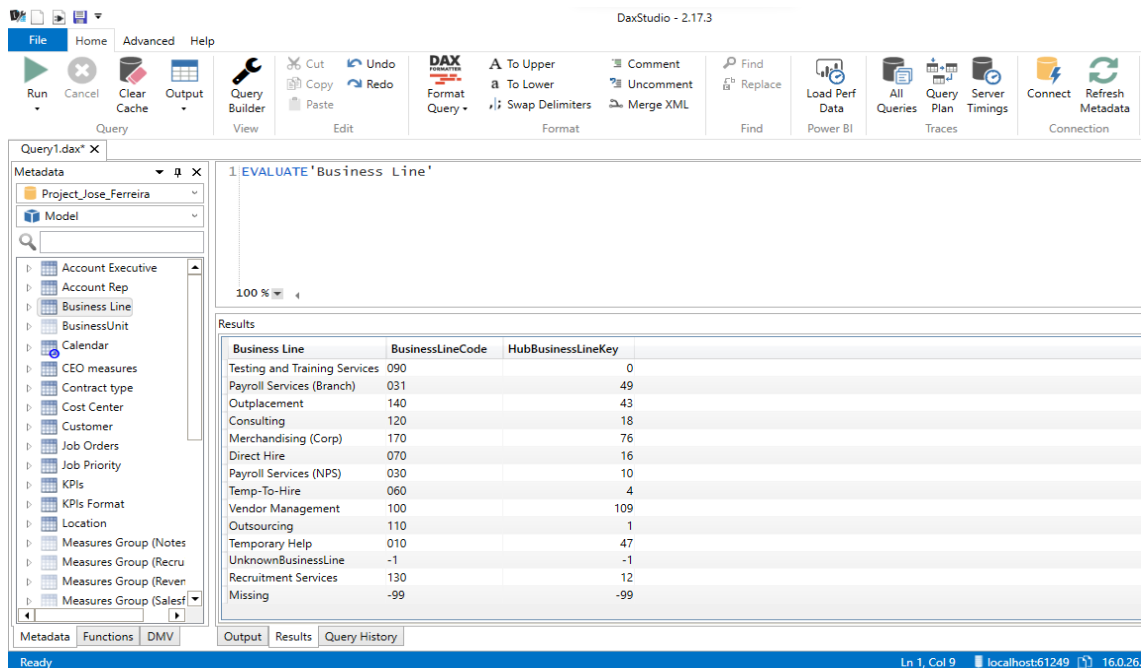
Figure 8 - Use of DAX to create the indicators



Source: Power BI Desktop

Despite being a powerful Power BI tool, when we create a measure, we cannot immediately see the results that were filtered out of the calculation, as the software cannot determine the result if it does not have a context. In this way, a new software was introduced to help to overcome the difficulties that may arise - DAX studio. It provided some help in the implementation of the BI solution, being a free client tool that allows us to perform advanced calculations and analysis of our Power BI, using DAX queries (see Figure 9). In this way, the program assists in writing more complete DAX formulas, particularly formulas that contain “tables” as part of the formula. In addition, it helps in learning how to write DAX queries and allows us to perform performance tests of our measures.

Figure 9 - Use of the DAX studio



Source: DAX studio

5.6.1. Indicators selection process

The choice of the most essential indicators for the company was another step in this process of implementing a BI solution, being essential to understand the main factors for the management of the business. Thus, selective parameters were discussed with the supervisor at DevScope, later separated by different groups of indicators. In choosing the performance indicators, the characteristics of a good indicator referenced by Franceschini et al. (2019) and Kerzner (2017) were taken into account, to guarantee the quality of the developed solution. In addition, there was an attempt not to present too many indicators or too complex indicators, as this could reduce the effectiveness of data analysis and interpretation, in accordance with what was referenced by (Franceschini et al., 2019)

This choice of indicators to be used in the project had the HR Connect's approval before the visuals were built, since the time spent on the project would be much higher if the company said that the indicators were not the most appropriate after the report was built. After this process of research and discussion of the most appropriate indicators for analysis, a list of the indicators was created, which are listed by category in the table below.

Table 2 - List of indicators used in the project

Category	Indicators
Finances	1. Revenue generated 2. Profit margin 3. Gross profit generated 4. Operating costs 5. Revenue per customer 6. Revenue per employee 7. Direct hire fees 8. Conversion fees 9. Total fees
Operations	10. N° of orders 11. Won opportunities 12. Jobs net effect
Customers	13. N° of customers 14. New customers by month 15. Lost customers by month 16. % of new customers by month 17. Churn rate 18. N° of orders per customer 19. Revenue of new customers 20. Average days since last order
Employees	21. New employees by month 22. Lost employees by month 23. N° of connects 24. N° of meetings 25. Active employees
Forecast	26. Orders forecast 27. Revenue forecast 28. New customers forecast

Source: Own elaboration

In this way, it was decided to perform the visualization of nine financial indicators, to have a clear image of the financial situation of the company and understand the values that it would be generating. For this, information on the level of revenue and profit generated by the company was obtained, and this information is contained in the "Revenue" fact table. Having these two indicators, it was also possible to perceive the amount of operating costs, just by subtracting from the value of the revenue generated by the company, the value related to profit. Another important financial indicator used in the reports was the value of the profit margin, being possible to obtain this value because in the dataset provided there is information regarding the amount charged to customers and the cost of the company with customers.

Two other important indicators that were created following the implementation of the project were revenue per customer and revenue per employee, both of which can provide a deeper level of knowledge than just the indicator of the total revenue value. Often, looking only at the revenue level, we can get the idea that the company is doing well because the revenue level remains the same as in previous years or even increased. However, if this increase was due to the hiring of a greater number of employees, this could mean that the company's profit margin may not follow the same behavior as revenues, since it will be necessary to pay wages to these workers. Thus, indicators such as revenue per employee intend to look at this problem and can be an important help to understand when this type of situation happens and take measures to solve it in time.

Regarding the operational indicators and given the database made available by HR Connect, it was noticed that some indicators would be more suitable to fulfill the objective. Thus, the indicators that could best demonstrate the company's situation would be the number of orders placed by customers, the number of business opportunities won and the net effect of jobs. The net effect jobs indicator concerns the variation between the jobs that the company started, that is, the processing of the order for the customer, and the jobs that ended, that is, the works requested from the company that it has already solved. Thus, it is intended that this indicator has the highest possible value, meaning that the company is having a good turnover, with the number of jobs that will start being higher than the jobs that have ended.

Conducting an analysis of customers is important for companies, to gain insights into them and gain a competitive advantage over competitors. This analysis has an impact on the definition of the company's strategy in the long term, being able to help the growth of the business volume through the identification of consumption patterns and capture of a certain market segment. In addition, customer analysis allows for a reduction in customer acquisition costs and greater customer retention.

Thus, it was necessary to have indicators such as the number of customers, new customers and customers lost in a certain period, the number of orders per customer or the average number of days since the last order, to be able to make a good analysis of the clients' portfolio. Knowing the new customers, it is also possible to calculate the indicator related to the sales value resulting from the new customers, being important for the company to carry out this analysis.

In addition to being able to analyze the percentage of new customers each month, it was necessary to create an indicator to analyze customer churn. This customer churn analysis gives us information on the percentage of customers that the company lost compared to the total number of customers at the beginning of the period. Churn can help the company understand why the customer left, if it was inevitable, or even predict that it might happen. Thus, we can check customer trends and try to increase their retention rate. To analyze churn, it was necessary to use a criterion to define a customer as lost. Thus, in this analysis, a customer was considered lost if he had not placed any orders in the last six months.

Just as it is important to analyze customers, it is also important to analyze employee performance. For this, an indicator was used to count the number of active employees of the company, being considered an active employee, any employee who has processed an order in the last six months. In addition, the indicator on the number of new employees and lost employees in the period under analysis was used. Finally, indicators were also used to measure the activity of each employee, counting the number of meetings and connections made by employees, to analyze their performance over time.

Regarding the forecast indicators, these were used with the objective of comparing the values of revenue, number of orders and number of new customers in the current period against what the company is expected to achieve. For this, it was defined that the values for the forecast would be the values of the same period in the previous year, with the company's objective being to obtain a better or similar performance to what happened in the previous year.

5.7. Building the dashboards

After these two important steps of integrating the data into the DW, which are now ready to be analyzed, and the construction of the indicators necessary for the preparation of the report, the stage of development of the dashboards follows. As mentioned before by Vieira et al. (2018), the dashboard aims to enable the user to access and visualize information in a quick, easy, and intuitive way, to make better business' decisions and monitor the business information. Thus, the most relevant indicators will be presented on the dashboards, so that we can obtain an overview of the business, to improve performance,

make better strategic decisions or assess the effectiveness of implemented processes, as mentioned by Alhamadi (2020).

The interpretation of the dashboard and the analysis of data is influenced by their design, with care being taken to ensure that all content was perceptible and presented in a pleasant way. Thus, there was an attempt to ensure an organization of the created dashboards, aligning the elements used, being consistent in terms of the choice of colors and graphics, and we sought to arrange the visuals to highlight the most relevant information.

In addition, context was shown whenever it proved necessary, to have a clear understanding of the data shown, and there was also an attempt to show variations in relation to other periods to allow a better analysis. The choice of graphs to be incorporated in the dashboards was also careful, being these chosen based on the type of data and the analysis that will be done, where, for example, a temporal analysis of an indicator over time will be better represented in a line chart, and an analysis of the types of products best sellers will be best represented on a pie or bar chart.

For this project, a Power BI with six pages was developed, constituted by an initial menu and five analyses carried out. The Power BI developed aims to reach the fundamental areas of the company and provide an overview of the company to the report user. These five areas of the company represented are an overview of the company, an analysis of its financial situation, its customers, its employees, and an overview of the defined KPIs and a comparison between the company's performance and the forecast. Having an interactive layout in which the user can navigate between pages regardless of which page they are on, with the objective that the CEO is able to collect relevant information about the company's performance from the five dashboards presented.

To follow what was mentioned by Figueiras (2014) and Frazier et al. (2012), in the elaboration of all the dashboards there was an attempt to create a storytelling so that when the user saw the project he was guided in the analysis performed. Thus, the organization of all visuals suggests a user-guided visualization, showing consistency in their arrangement across the different dashboards. To improve this storytelling experience, a home menu was also created, where the layout of the links to the dashboards will also influence the visualization of the entire project.

5.7.1. Home menu

As seen in Figure 10, in the home menu the user can quickly choose the dashboard he wants to see first, also allowing a visualization of all the contents of the report. The purpose of this page was to have a simple layout, showing only the name of the company and a short reference to the type of report that will be presented. The layout developed allows a navigation menu to be found on the left side in all dashboards, having been created using buttons, an important capability of Power BI that allows the page navigation and adds dynamism to the report. In addition, information regarding the last refresh date of the report was placed in the upper right corner, allowing the user to see if the data is current or if there is a need to refresh them.

Figure 10 - Home menu



Source: Power BI Desktop

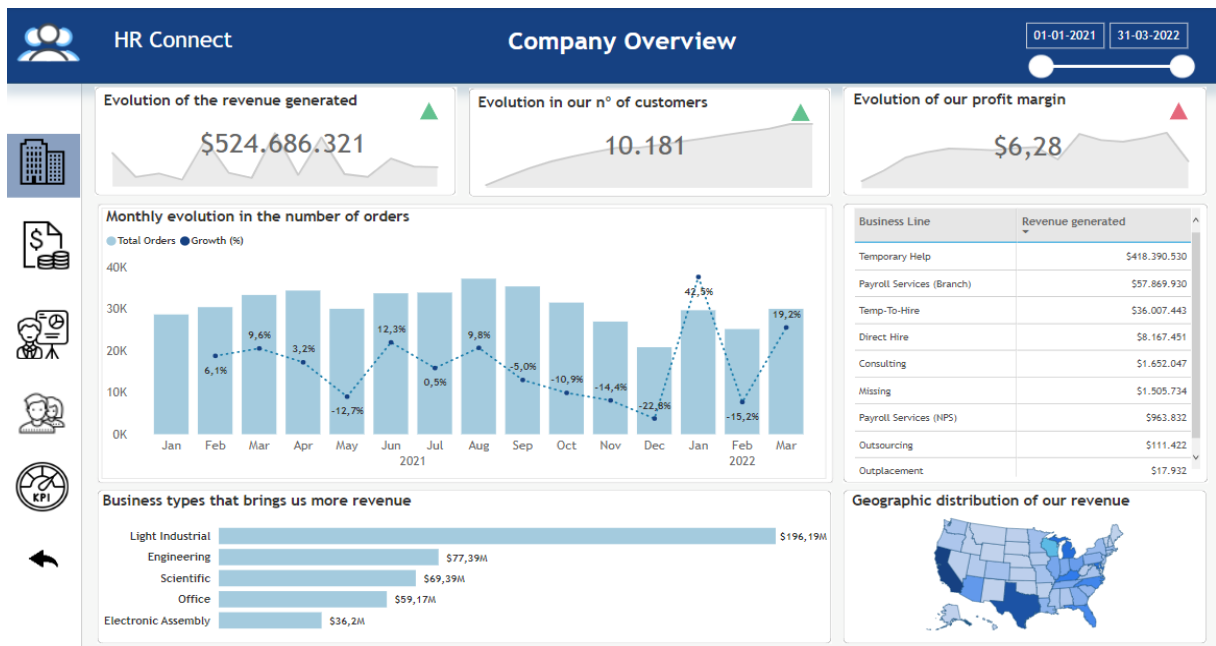
5.7.2. Dashboard – Company overview

As mentioned before, this dashboard aims to provide a quick analysis of the company's situation, grouping indicators from various areas of the company to give an overall picture. Thus, this dashboard presents information that appears in the other four dashboards, so that the CEO can quickly gain insights into all the important areas to be analyzed. Following the instructions on storytelling with visualizations, this dashboard is the

first to be presented in the constant menu on the left side, serving as an introduction to the analyzes to be carried out in the rest of the project.

The dashboard intends to serve as a means capable of providing the user with an appealing visualization of the data contained in the Excel files provided by HR Connect, facilitating the analysis and interconnection of data. Thus, as can be seen from Figure 11, the dashboard allows for a faster and more appealing visualization of all data, reducing the analysis time that would be spent if the solution did not exist. Thus, it was necessary to have a general understanding of the entire activity of the company, to ensure that the indicators presented are the most relevant. In addition, it is necessary to understand the company's activity to ensure a correct organization of the visuals to give greater relevance to the most important indicators.

Figure 11 - Company overview



Source: Power BI Desktop

5.7.3. Dashboard – Financial situation

In the development of this financial dashboard, there was an attempt to use all the indicators that were created that had a more financial and not so much operational base. Thus, it was possible to present information on the revenue generated by the company, its

gross profit, the operating costs, revenue per customer and per employee and the charged fees, showing a picture of the company's financial situation (see Figure 12).

It is expected that the dashboard will help to optimize the company's management, leading to an improvement in its financial situation. In addition, the dashboard may be able to allow a comparison of the financial situation of HR Connect with other companies in the same sector.

Figure 12 - Financial situation



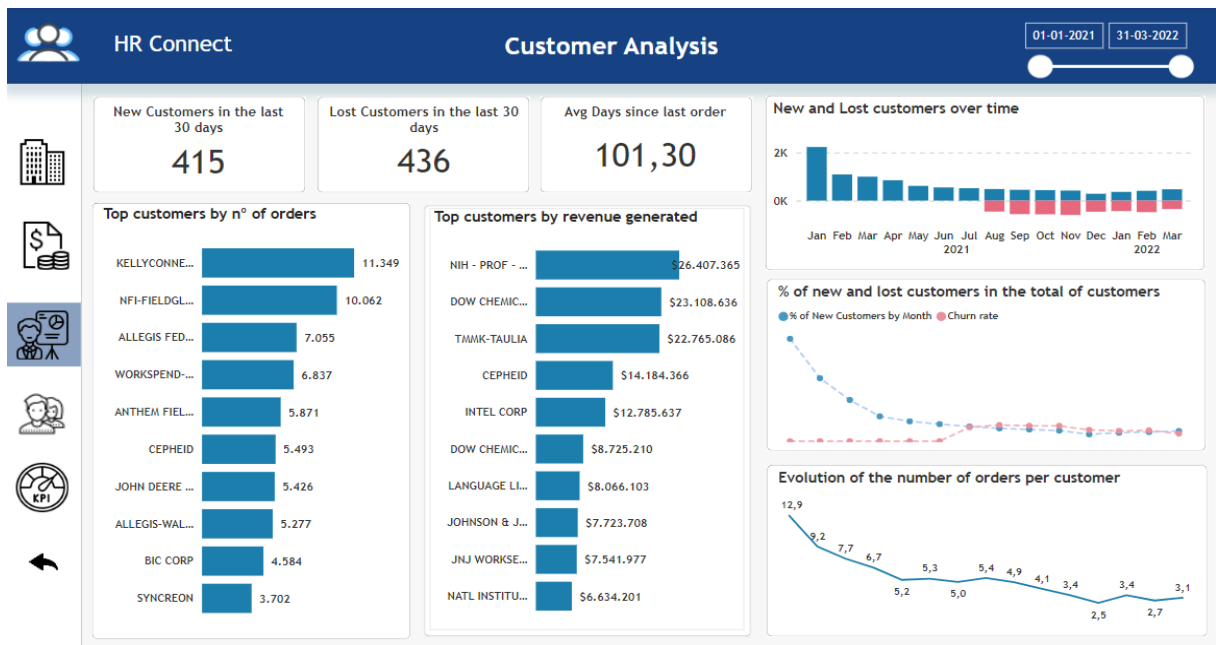
Source: Power BI Desktop

5.7.4. Dashboard – Customer Analysis

Given the company's needs, it was clear that an analysis of the customers of HR Connect would be essential to understand its business situation. Thus, and given the data provided by the company, it was possible to carry out an analysis of new and lost customers, the days since the last order placed, the top customers by revenue generated and number of orders and the number of orders per customer. Through all this information, it is intended to create a profile of the customers of HR Connect, as well as to provide the CEO an understanding of the new and lost customers in the company.

The need to analyze these large amounts of data to obtain customer insights and a comparative advantage over competitors arises from the greater focus of companies on providing a personalized service to the customer. This more customer-focused attitude also leads to greater difficulty in customer retention, which showed it was essential to create a dashboard of this type, as shown in Figure 13. At the customer level, it is intended, with the construction of such a dashboard, that the company can reduce customer acquisition costs, increase customer retention rates, increase sales volume, and profit and provide more streamlined and effective customer service.

Figure 13 - Customer analysis



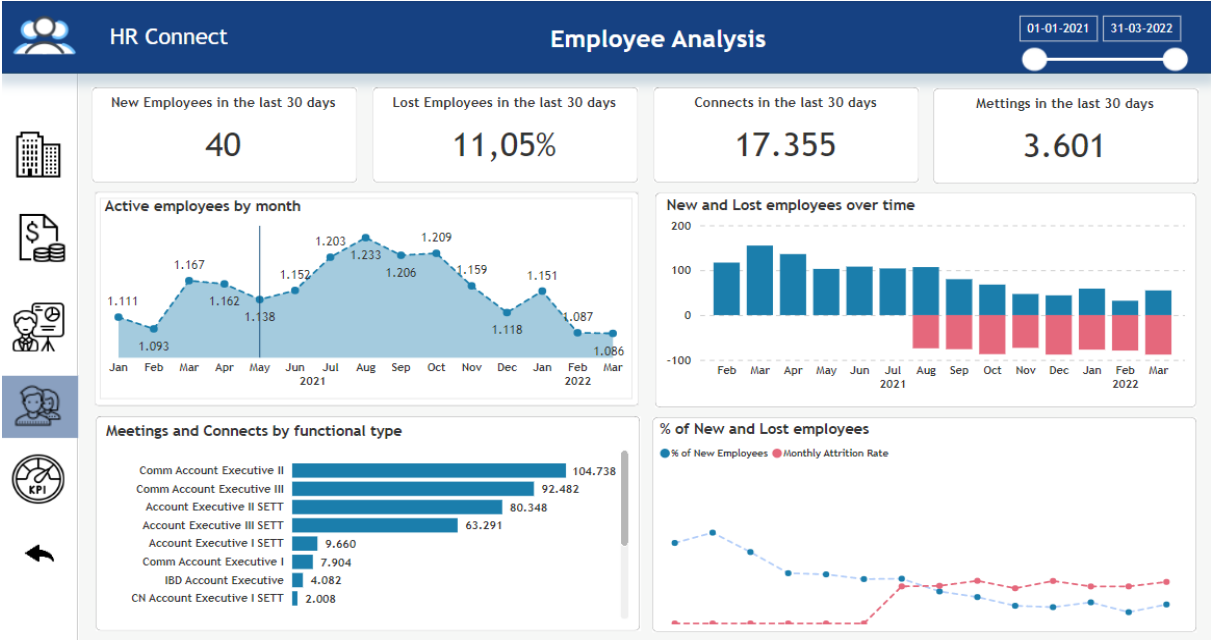
Source: Power BI Desktop

5.7.5. Dashboard – Employee Analysis

An analysis of HR Connect employees, namely at the level of the company's different teams, was also essential to make an overall analysis of the company, as it was said by the CEO in the first interview. In this way, an analysis like the one done to the customers was initially carried out, as the number of new employees and lost employees was quantified, as well as the total number of employees in each month. In addition, a measurement of the operations carried done by the employees was made, measuring the number of meetings and connects carried out, and analyzing each functional type of employee.

In this way, the employee analysis dashboard intends to regularly evaluate the performance of HR Connect employees, to improve the decision-making that the CEO will have to carry out (see Figure 14). Thus, it is expected that decisions such as bonuses, salary increases, or promotions will be made based on the information contained in the dashboard. In addition, it is expected that this dashboard will also serve as a way to monitor the number of employees in the company, as well as new and lost employees. This is intended to ensure that HR Connect is operating with the ideal number of employees in view of the needs and activities it intends to develop.

Figure 14 - Employee analysis



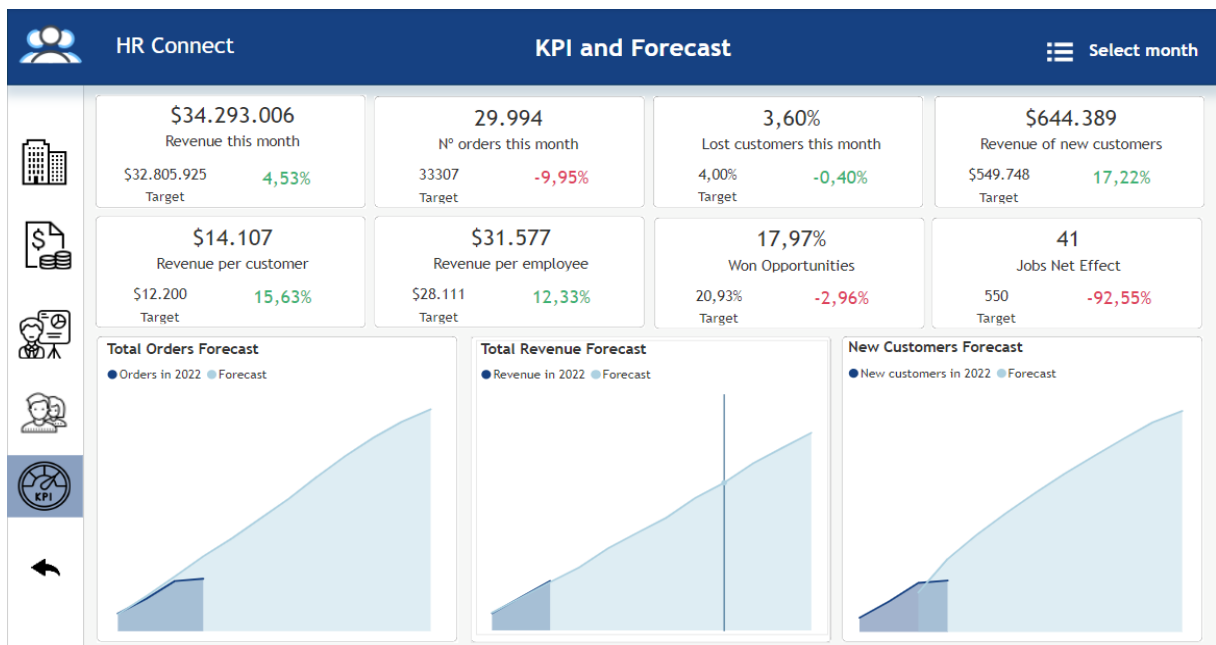
Source: Power BI Desktop

5.7.6. Dashboard – KPI and Forecast

Finally, the last dashboard created aimed to allow the user to select the month in which he wants to focus his analysis, viewing a set of company KPIs and a forecast of the orders, forecast and new customers (see Figure 15). This dashboard is the only one in which the top right does not use a slicer to choose the period, but a menu that allows you to choose only the month you want to analyze. The set of KPIs are related to different areas of the company, such as the level of revenue, revenue per customer and employee, the number of orders, lost customers, revenue from new customers, opportunities won and net effect jobs.

Thus, the user can quickly check the value of the indicator on each card, the company's objective for each indicator in that month and the variation between the value of the indicator and the objective. The objective is to allow to quickly analyze which areas of the company are overperforming and underperforming in the selected month, so that more informed business decisions can be made. Regarding the line charts, the user quickly understands the evolution of the company's activity throughout the year, comparing with the forecast made. Thus, this is expected to anticipate the CEO's decision-making considering the company's needs.

Figure 15 - KPI and Forecast



Source: Power BI Desktop

5.8. Presentation of the solution to the customer and evaluation

After the development of the BI solution, it was presented to HR Connect, so that it can evaluate the solution. When sharing the project with the company, it was also decided to carry out a post-implementation interview, to understand the quality of the developed solution and how it improved the company's processes (see Appendix C) as well as the survey carried out with DevScope workers to evaluate the project at a technical level.

Another capability of the Power BI was used - the Power BI Service. It allowed to create a workspace together with the HR Connect's representatives. Thus, it will be possible

to share the entire project, defining viewing permissions, as well as the database used and other important files. After the workspace is created and the project published, the company CEO and other members will be able to view and interact with the report through this cloud-based service.

After the analysis of the BI solution by HR Connect staff, Interview 2 with CEO was carried out. The evidence showed that the solution was useful to the company. In the interview, it was noticeable that the BI solution was able to satisfy the company's needs, having covered all the previously established requirements. Furthermore, when asked if the indicators provided the information needed for decision making, the answer was affirmative.

The CEO of HR Connect stated that “the information contained in the dashboard allows a quick understanding of the company's health over the main areas” (Interview 2). It was also stated during the interview that the information presented was reliable and provided in a clear way, allowing for a summary analysis and a more focused analysis. Regarding improvements that could be implemented in the project, the HR Connect representative said that it would be useful in the future to have an analysis of the talents that the company has been hiring over the years.

Regarding the solution's ability to influence business decisions, it was stated that it improved the business decision-making process. This improvement was due to the fact that “report facilitates the interactions between the CEO and his direct reports and allows a quick understanding of the most critical areas over which there is a need for a more in-depth analysis” (Interview 2). It was also stated that the implementation of this solution allowed to save hours of work in the collection of information, also allowing to reduce paperwork costs. Thus, there was a need to carry out training sessions to encourage the adoption of the tool, allowing a relief from the company's IT department workload.

The survey answered by BI developers of DevScope provided several results and allowed me to test the quality of the solution. Collecting this feedback from experienced workers in the BI area of the company allowed me to ensure the quality of the project developed. Improvements could be made to the work developed, serving the survey as an aid to perceive areas for improvement. Through the survey it was noticeable that, in general, the inquired specialists considered that the developed solution had quality. The evaluation

was on average of four in most of the parameters placed in the questionnaire, having been satisfied with this result.

6. Conclusion

This chapter presents a research summary with the conclusions of the BI solution project. In addition, the project's contributions, both practical and theoretical, as well as limitations and future implications for research are presented. Thus, based in the literature review and using a case study method, this study responds to the following research problem: what solution can solve the lack of quick collection of information necessary for the CEO to understand the current situation of the company.

6.1. Research summary

The study carried out had as main objective to develop a BI solution, capable of providing relevant information to HR Connect's CEO, helping in the improvement of the decision-making. For this, there was a need to understand the opportunities that arise from the analysis of company data through BI, to support business management. To fulfill the objectives of the study, the case study method was used, which allows the researcher to be able to develop insights into a complex and real phenomenon, capturing the richness of the situation that is under investigation (Arisha & Ragab, 2018; Ebneyamini & Sadeghi Moghadam, 2018).

To fulfill the research objective, initially an interview was developed to understand the company's needs and requirements. Thus, it was noticeable that HR Connect was looking for a BI solution that could help them solve the problems presented. Since the company already had a BI solution at the operational level, it realized that developing a high-level solution for the CEO, could provide him a picture of the company's situation. There was a need to develop a BI solution capable of carrying out an analysis of the most important areas of the company, analyzing the financial, operational, KPI's and forecast compliance, of customers and employees.

There was a study of the solution that best applied to the needs of HR Connect, realizing the particularities of the implementation of each stage, having the notion that each solution has its specificities. The processes described were the definition of the BI system architecture, implementation of the ETL process, definition and implementation of the multidimensional model, creation of performance measurement indicators and of

dashboards. The final objective of understanding the implementation of the BI solution was to be able to show the importance of dashboards created to allow access, exploration, and visualization of information by the user.

The second issue raised by the implementation problem was to understand to what extent the implementation of the solution can contribute to an improvement in the decision-making of the company's CEO. For this, feedback was collected from those responsible for HR Connect, to understand how the implementation of the BI solution was beneficial for the company. Having complied with the requirements and satisfied the company's needs, the person in charge of HR Connect stated that the solution developed allowed him to understand the company's health over the main areas.

This ability to analyze the different areas allows an improvement in decision making, and the presentation of a huge amount of data is done quickly, allowing a complete analysis. The elaboration of this project allowed the company's CEO to also be able to improve interactions with the company's employees, having the analysis of dashboards as the basis for measures taken. Thus, there was a need for the company to carry out training sessions to encourage the adoption of the tool and ensure that it is used in the best way. It was possible to perceive the benefits of implementing the solution for the company, as well as possible limitations in this process, making it possible to make a relationship with what was presented in the literature review.

6.2. Theoretical and practical contributions

A BI system aims to guide the decision-making process, through the collection, treatment, analysis, and use of strategic information for the company. To carry out this process, there is a need to use analysis tools to provide the necessary information to support decision-making. The project developed during the internship period corresponded to the introduction of a new vision of the BI solution implementation process at DevScope. As a company closely linked to technology and engineering, there was not a great demand for the economic and business foundation of the projects developed in the area.

Thus, despite the concepts presented regarding the BI concept, the system architecture or the dimensional modeling of the data are not new for the company, the search for benefits and possible obstacles was underdeveloped. In addition, knowledge regarding

measuring business performance or choosing indicators for analysis was introduced to complete the economic and business motivations behind a BI solution. From the presentation of this knowledge, it is intended to help DevScope to understand the needs and economic motivations of its customers, and this perception can lead to an improvement of the solutions developed. This study also contributes to the literature on the link between BI solutions and business performance.

The solution developed for HR Connect also became an asset for it, as the collection, processing and presentation of data allowed to provide an image of various areas of the company that had not happened until then. Since, until then, the company's employees only had this information at the operational level, this solution allowed the CEO to access new information, to support decision-making in the organization. Thus, it was possible to reduce the time spent to carry out this type of analysis, which until then would only have been possible by viewing the various files in Excel format.

The project developed during the internship showed that the implementation of BI systems in companies makes it easier to extract relevant information from data that were dispersed, integrating them into a DW. It is thus clear that by collecting this type of information about the business, it is possible to improve decision-making, ensuring better management of the organization, being able to reach its various levels.

The fact that this project was developed in an organizational environment and given the scope of the tasks carried out, proved to be an asset in the training of the author, developing it both at a professional and personal level. This project allowed the acquisition of professional skills with tools such as Microsoft Power BI and DAX studio, and a deepen knowledge on the development of a BI solution. Given the constant space for development that a learning process contains, the next sub-chapter also presents notes on future work, as well as the limitations found.

6.3. Limitations and future research

Despite having developed a functional solution capable of meeting the company's requirements and needs to support strategic management, this work still has room for improvement. To overcome some of the limitations that have arisen, a set of points to be

considered in the elaboration of future works are highlighted, with a view to improving the work started here.

The first limitation that arose in the development of this project was the short duration of time, insofar as it lasted only four months, it did not allow us to observe all the particularities of the development of the solution. Having just over three months to develop the BI solution to meet the customer's needs, the end of its development was close to the end of this study. Thus, it was not possible to perceive the impact of the solution in the medium and long term for the company, being interesting to carry out this analysis. With that, it would be possible to attribute an economic value to the developed solution, through a measurement of the reduction of the company's costs resulting from the implementation.

The survey carried out with DevScope employees also appears as a good starting point to understand possible improvements to be made in future work, namely in terms of dashboard visualization. As Power BI is a program that is constantly being updated, new features may also appear that can streamline the processes that have been described, and it is important to be constantly updated. The understanding of the multidimensional data model was another of the limitations encountered during the project, due to its high complexity as it contains a large number of fact and dimension tables. Thus, it would be advisable for future work to spend more time figuring out whether all the tables would be fundamental for the analysis that was intended to be carried out, removing those that would be unnecessary.

Finally, it would also be important to understand how it will be possible to carry out the maintenance of a BI solution of this kind for the HR Connect, making a description of the activities carried out to do this maintenance. This was not possible in this project due to the limitation imposed by the deadlines to deliver the report and the duration of the internship, but it will be interesting to develop it in future work. Thus, it would be possible for the reader of the report to understand all the steps of the process of implementing a BI solution.

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Appendices

Appendix A - Points focused on the pre-implementation interview with HR Connect

- Main reason the company needs a BI solution;
- Operational improvements they want to see made and problems they are trying to overcome;
- How they expect the solution to save time, money and resources;
- New tasks expected to be done after implementation;
- The indicators that the company considers fundamental to measure its success;
- How the company maintains its database before implementation and what BI strategy they follow;
- Company culture in relation to BI;
- What problems do you hope the solution can solve;
- Departments or people affected by the BI strategy;
- Requirements required by the company and available resources;
- The time required for delivery of the solution;

Appendix B - DAX formulas used to create indicators

Table A. 1 - Financial indicators

DAX Formula	Indicators	Explanation
<code>SUM(Revenue_Table[Column])</code>	1. Revenue generated 3. Gross profit generated 7. Direct hire fees 8. Conversion fees	Makes the sum of all records contained in the selected column
<code>[Avg Bill Rate (WNO)]-[Avg Pay Rate (WNO)]</code>	2. Profit margin	Subtract from the average amount charged by the company, the average cost to the company
<code>[Total Revenue]-[Primary Gross Profit]</code>	4. Operating costs	Subtract the profit obtained from the revenue generated
<code>DIVIDE([Total Revenue],[N° of customers])</code>	5. Revenue per customer	It divides the n° of customers and the revenue that the company generated
<code>DIVIDE([Total Revenue],[Active employees])</code>	6. Revenue per employee	It divides the n° of employees and the revenue that the company generated
<code>[Conversion Fee] + [Direct Hire Fee]</code>	9. Total fees	Add the two types of fees charged by the company

Source: Own elaboration

Table A. 2 - Operational indicators

DAX Formula	Indicators	Explanation
COUNTROWS('Job Orders')	10. N° of orders	Counts all the rows contained in the fact table of the orders placed by the customers
CALCULATE([Opportunities], 'Opportunities'[Opportunity Status] = "Won")	11. Won opportunities	Counts the number of opportunities that have been won, applying a filter where the status is "Won"
[Job Starts]-[Job Ends]	12. Jobs net effect	Calculates the net effect job, subtracting from the jobs started the jobs that have already finished

Source: Own elaboration

Table A. 3 - Customer indicators

DAX Formula	Indicators	Explanation
DISTINCTCOUNT('Job Orders'[HubCustomerKey])	13. N° of customers	Counts the n° of customers of the company at any given time
CALCULATE([N° of customers], EXCEPT(Current_Values, Existing_Values))	14. New customers by month	Counts the n° of new customers, creating two variables to get the existing n° of customers and the past value, to know which clients are new
COUNTROWS(FILTER(customerlist, CALCULATE(COUNTROWS('Job Orders'), FILTER(ALL('Calendar'), 'Calendar'[Date] >= MIN('Calendar'[Date]-churndate && 'Calendar'[Date] <= MIN('Calendar'[Date])))=0)))	15. Lost customers by month	Counts the number of customers who have not placed any orders in the last 180 days (period defined by churn to report a customer as lost)
DIVIDE([New customers by month],[Running customers beginning])	16. % of new customers by month	Divide the n° of new customers in a given month by the total n° of customers at the beginning of the month
DIVIDE([Lost customers by month],[Running customers beginning])	17. Churn rate	Divide the n° of lost customers in a given month by the total n° of customers at the beginning of the month
DIVIDE([Total Orders],[Running total customers])	18. N° of orders per customer	Divide the total n° of orders by the total n° of customers
CALCULATE([Total Revenue], EXCEPT(Current_Values, Existing_Values))	19. Revenue of new customers	Sums the revenue generated by new customers, using EXCEPT to find out the new customer registrations
CALCULATE(AVERAGE(Customer[Days since last order]), Customer[Customer Status] = "Active" Customer[Customer Status] = "New")	20. Average days since last order	Does the average of days since last order only for active and new customers (does not calculate it for lost customers)

Source: Own elaboration

Table A. 4 - Employee indicators

DAX Formula	Indicators	Explanation
<code>CALCULATE([Active employees], EXCEPT(Current_Values, Existing_Values))</code>	21. New employees by month	Counts the number of new employees in each month, using EXCEPT to find out the new employee's registrations
<code>COUNTROWS(FILTER(employeelist, CALCULATE(COUNTROWS('Job Orders'), FILTER(ALL('Calendar'), 'Calendar'[Date] >= MIN('Calendar'[Date]) - churndate && 'Calendar'[Date] <= MIN('Calendar'[Date])))=0))</code>	22. Lost employees by month	Counts the number of employees who have not fulfil any order in the last 180 days (period to report an employee as inactive)
<code>SUM(Salesforce[TotalConnects])</code>	23. N° of connects	Makes the sum of all the connects done, present in the Salesforce fact table
<code>SUM(Salesforce[TotalMeetings])</code>	24. N° of meetings	Makes the sum of all the meetings done, present in the Salesforce fact table
<code>DISTINCTCOUNT('Job Orders'[HubStaffKey])</code>	25. Active employees	Counts the n° of active employees of the company at any given time

Source: Own elaboration

Table A. 5 - Forecast indicators

DAX Formula	Indicators	Explanation
<code>CALCULATE([Total Orders SPLY], FILTER('Calendar', 'Calendar'[Year] = 2022))</code>	26. Orders forecast	As the basis for the forecast is the previous year, the formula obtains the n° of orders in the same period of the year before the filter year (2022)
<code>CALCULATE([Total Revenue SPLY], FILTER('Calendar', 'Calendar'[Year] = 2022))</code>	27. Revenue forecast	As the basis for the forecast is the previous year, the formula obtains the amount of revenue in the same period of the year before the filter year (2022)
<code>CALCULATE([New customers by month SPLY], FILTER('Calendar', 'Calendar'[Year] = 2022))</code>	28. New customers forecast	As the basis for the forecast is the previous year, the formula obtains the n° of new customers in the same period of the year before the filter year (2022)

Source: Own elaboration

Appendix C - Points focused on the post-implementation interview with HR Connect

- The needs and requirements expressed by the customer have been resolved with the information provided in the dashboards;
- Indicators created allow the user to obtain the management information necessary for decision making;
- The information provided in the reports is accurate, reliable and up to date;
- The output is presented in a useful way to communicate insights effectively;
- The reports have the functionalities required to do a good analysis;
- Employees can quickly gain insights by analyzing dashboards;
- The data is broad enough in scope to provide a complete picture;
- Examples of how this project led to an improvement in the decision process;
- Allowed the company to improve processes that resulted in a reduction in its costs;

- Allowed an alleviation of the company's IT workload department;
- The user was able to ask new questions about the data;
- The KPIs chosen for analysis allow the user to draw correct conclusions about the general situation of the company;
- Mental opening of the company's employees to the importance of Power BI in making business decisions;

Appendix D - Survey conducted on DevScope employees

The following statements were presented to DevScope employees in the BI area, with a score between 1 and 5 given the degree of agreement (with the exception of the 13th).

1. The user feels that there is a good organization of the project
2. There is an ease of reading the presented visuals.
3. The information presented is clear in all visuals.
4. The user can easily identify trends in the displayed data.
5. The user feels that the information presented allows for an overview of the company's situation.
6. The chosen visuals are the most advisable to present the information contained therein.
7. The report is prepared in a format where it is easy to navigate between pages.
8. The slicers in the dashboards are correctly filtering the information presented.
9. The menu to select the month in the KPI's dashboard is presented in a way that is simple to use.
10. There is consistency in the organization of visuals across the various dashboards.
11. The colour palette used in the dashboards allows a pleasant visualization for the user.
12. The initial menu is well structured and allows you to quickly choose the page you want to view.
13. Do you feel that there is any improvement that could be made? if yes which one?

