UNIVERSITAT POLITÈCNICA DE VALÈNCIA

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School of Informatics

Financial data visualization: A comparison between SAC, Analysis for Office and Power BI

End of Degree Project

Bachelor's Degree in Data Science

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ACADEMIC YEAR: 2023/2024

Abstract

Nowadays, the increasing amount of data that companies produce and manage can be a problem if the right tools are not used to extract the necessary information. As a result, the importance of Business Intelligence - a discipline focused in helping companies extract valuable insights from their data and enhance decision-making - is growing.

The project focuses on the evaluation and comparison of three Business Intelligence platforms: SAP Analytics Cloud (SAC), SAP Analysis for Office and Power BI. These tools are essential for many companies worldwide, as they enable the construction of dashboards and reports that facilitate the extraction of valuable information from their data.

One of the main objectives of the thesis is to elaborate a guide to help the employees of the company that provided the data to choose the most suitable platform for their needs. For this purpose, characteristics such as the data that users have access to, the visual elements that can be used, the possibilities for data transformation and the types of devices on which they are available will be analysed and compared.

In addition to the creation of the guide, this thesis also includes the development of a dashboard that is updated on a daily basis. This dashboard will allow the Chief Financial Officer (CFO) and other managers of the company to visualise the financial and operational situation of the company in real time. The aim is not only to improve strategic decision making within the company, but also to demonstrate the practical value of the applications evaluated. For its creation, mainly sales data of the company that has collaborated in the elaboration of this thesis will be used.

Keywords: SAC; SAP Analysis for Office; Power BI; Business Intelligence; Data visualization; Daily dashboard;

Resumen

En la actualidad, la cantidad creciente de datos que las empresas producen y gestionan puede suponerles un problema si no se utilizan las herramientas correctas para extraer la información que desean. Ante esto, aumenta la importancia de la Inteligencia de Negocios, una disciplina centrada en ayudar a las empresas a extraer información valiosa de sus datos y en mejorar la toma de decisiones.

Este proyecto se centra en la evaluación y comparación de tres plataformas de Inteligencia de Negocios: SAP Analytics Cloud (SAC), SAP Analysis for Office y Power BI. Estas herramientas son esenciales para muchas empresas alrededor del mundo ya que permiten la construcción de tableros de gráficos e informes, lo que les facilita la obtención de información útil a partir de sus datos.

Uno de los objetivos principales de este TFG es la elaboración de una guía que ayude a los empleados de la empresa que ha proporcionado los datos a elegir la plataforma más adecuada según sus necesidades. Para ello, se analizarán y compararán aspectos como los datos a los que los usuarios tienen acceso, los elementos visuales que se pueden construir, las posibilidades para la transformación de datos y los dispositivos en los que están disponibles.

Además de la creación de la guía, en este TFG también se desarrolla un dashboard que se actualiza diariamente. Este permitirá al director de finanzas y otros directivos de la compañía visualizar la situación financiera y operativa de la empresa en tiempo real. Con su elaboración, no solamente se busca mejorar la toma de decisiones estratégicas, sino que también se quiere demostrar el valor práctico de las aplicaciones evaluadas. Para su creación, se utilizarán principalmente datos de ventas de la empresa que ha colaborado en la elaboración de esta tesis.

Palabras clave: SAC; SAP Analysis for Office; Power BI; Inteligencia de negocios; Visualización de datos; Tablero diario;

Resum

Actualment, la quantitat creixent de dades que les empreses produeixen i administren pot suposar-los un problema si no utilitzen les ferramentes correctes per a extreure la informació que desitgen. Per aquest motiu, augmenta la importància de la Intel·ligència de Negocis, una disciplina centrada en ajudar als negocis a obtindre informació valuosa gràcies a les seues dades i en millorar la seua presa de decisions.

El projecte es centra en l'avaluació i comparació de tres plataformes d'Intel·ligència de Negocis: SAP Analytics Cloud (SAC), SAP Analysis for Office i Power BI. Aquestes eines són essencials per a moltes empreses a nivell mundial ja que permeten la construcció de taulers de gràfics i informes que faciliten l'extracció d'informació a partir de les seves dades.

Un dels objectius principals del TFG es l'elaboració d'una guia que ajude als treballadors de la companyia que ha facilitat les dades a triar la plataforma més adequada segons les seues necessitats. Per a això, s'analitzaran i compararan aspectes com les dades als quals els usuaris tenen accés, els elements visuals que es poden utilitzar, les possibilitats per a la transformació de dades i els dispositius en els quals estan disponibles.

A més de la creació de la guia, en aquest TFG també es desenvolupa un tauler de gràfics que s'actualitza diàriament. Aquest permetrà al director de finances i altres directius de l'empresa visualitzar la situació financera i operativa de la companyia en temps real. Amb aquest, no solament es busca millorar la presa de decisions estratègiques dins de l'empresa, si no que també es vol provar el valor pràctic de les aplicacions avaluades. Per a la seua creació, s'utilitzaran principalment dades de vendes de l'empresa que ha col·laborat en l'elaboració d'aquest project.

Paraules clau: SAC; SAP Analysis for Office; Power BI; Intel·ligència de negocis; Visualització de dades; Tauler diari;

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1. Introduction

1.1. Motivation

Nowadays, data is one of the most valuable resources for companies, but it is worthless if the desired information cannot be extracted from then. For this reason, disciplines such as Business Intelligence, whose main purpose is to help corporations extract valuable insights from their data, are becoming increasingly important.

To this end, companies such as the one providing the data for this project have been incorporating software to help them make use of their data. Specifically, the company began incorporating technologies developed by SAP, starting with SAP Analytics Cloud for Microsoft Office and continuing with SAP Analytics Cloud. Recently, they have expanded the range of possibilities by adding Microsoft Power BI. But with so many different tools available, a problem arises among the company's employees: Which tool should I use?

With this question in mind, we get to the main motivation for this project, which is to help the company’s users to choose the most suitable Business Intelligence tool depending on their needs.

1.2. Goals

As mentioned in the previous section, this project arises from a company's need to help its employees choose the optimal tool for tasks related to business intelligence and especially data visualization.

With this motivation in mind, the two objectives that guide the development of this project emerge:

- **Creation of a guide to help employees navigate through the Business Intelligence tools:** As mentioned in the preceding section, the company currently has three platforms that allow them to visualize data in several different ways. The aim of this first objective is to create a guideline based on both the technical characteristics of the tools and the specific characteristics of the company. To this end, an exhaustive search and analysis of the tools must be carried out. At the same time, close contact should be maintained with the company to carry out a study of the company's features to understand how the applications are integrated into its infrastructure. The purpose behind this is to offer them a result adapted to the context of the company.

- **Creation of a visualization tool:** The second goal of this thesis is the creation of a visualization tool for upper management, specifically a dashboard that facilitates the extraction of daily information about the organization. In addition to offering a product to the company, this dashboard should serve two purposes. The first is to apply some of the information gained from the comparison developed in the previous objective. The second is to identify more practical and specific differences between the software options that are being studied.

Together with the action that will be carried out to achieve them, these two mentioned objectives will constitute the main focus of this Bachelor's thesis.

1.3. Relationship of the work developed with the Bachelor´s studies

One of the interesting aspects to discuss and consider regarding the carried-out work is the relationship between the studies undertaken in the Data Science program and the developed project. Specially, given that the thesis has had a very practical and close experience to real-world work.

Although this project is mainly focused on data visualization and the comparison of tools used for it, I have also had the opportunity to study the actual database infrastructure of a company. This has allowed me to see concepts from the "Database" course in applied in real life. Furthermore, the knowledge acquired in this course and, more specifically, in the practical part, was also of great help when using one of the visualisation platforms, especially when loading and transforming data.

As mentioned in the previous paragraph, one of the main fundamentals of this thesis is data visualization. More specifically, it has been possible to apply concepts learnt during the corresponding subject. Some of the learnings that can be seen represented in the result are not only purely visual concepts such as colour theory or font typography, but also more theoretical concepts such as the choice of graphics or the structure and legibility of the dashboard.

Other knowledge acquired during the Bachelor's that has been of great help during the development of this thesis has been the structuring and organisation of the work. Related to this, the project subjects taken in each of the first three years of the degree are worth of being mentioned.

Finally, one of the most important and useful aspects I have been able to learn throughout my studies is the development of transversal competences. These are skills that go beyond purely technical knowledge and are essential for navigating successfully through professional roles and real-world problems. Practicing collaboration, critical thinking, effective communication, and planning and management of time within multidisciplinary groups is crucial for their progress. In fact, the seamless integration of team members and the establishment of strong interpersonal relationships are fundamental pillars for project success. Verbal and written communication skills further enhance cohesion within the work group.

To sum up, the elaboration of this work has not only made use of the technical knowledge acquired during the degree but has also played a fundamental role in the development of the soft skills that have been put into practice throughout the studies.

1.4. Structure of the thesis

As mentioned in Section 1.2, this work aims to achieve two objectives:

- Comparison of business intelligence tools
- Creation of a visualization tool

Consequently, the structure of the project is strongly related to these two milestones. In order to try to follow the development chronology of this project, first the comparison of the software and then the creation of the dashboard will be presented, dedicating a chapter to each of them. These two chapters are named “Business Intelligence tools” and “Creation of a visualization tool” respectively.

In the first of these, the context of the company is explored, focusing on the data infrastructure and its connection to the studied software. Moreover, for each of the tools some characteristics like the type of applications or visual elements that can be built are analysed. Finally, after comparing the features of the different platforms, the results are displayed with the creation of a guideline.

In the chapter corresponding to the second goal, the process of the development of the dashboard is explained thoroughly. Its objectives are defined first, followed by an explanation of the reasons behind the selection of the tools used for it. Other topics like the description of the data sources and variables, how the data was acquired and the process that was followed for building the dashboard can be found in this section. Furthermore, the final results of the daily management dashboard are presented along with other differences found between the tools during its construction.

These two chapters, which represent the core of the project, are preceded by a section on theoretical background in which an introduction to Business Intelligence is given, summarising the pillars of the subject as well as its evolution and relationship with other disciplines heavily related to Data Science such as Machine Learning and Artificial Intelligence. After explaining the development of the objectives and presenting the results, the legal and ethical framework is described, paying special attention to the measures taken to ensure data protection. Finally, the thesis concludes with a chapter in which the achievement of the established goals is validated, along with the proposals for improvement and legacy.

2. Theoretical background

Business Intelligence, also known as BI, is a discipline that mainly aims to help companies to extract valuable information from their data, specially targeting to improve their decision making.

Its importance lies in the fact that, nowadays, most business decisions are mainly based on mere intuition instead of facts, which can be avoided by benefiting from analytics. The application of Big Data can also be better exploited if it is combined with the power of BI. Moreover, thanks to analytics, data can be better used to differentiate a company from their competitors [1].

2.1. BI fundamentals

Business Intelligence is a complex field where a lot of concepts should be considered to fully understand how it works. Some of these are the enablers, the different perspectives, the BI cycle, how the applications are developed and selected and how it is related to data.

2.1.1. BI enablers

Technology, people and corporate culture are the three factors that have helped Business intelligence evolve.

Some of the improvements in technology that have facilitated the development of modern BI are the increasing of processing power, the arrival of network technologies and the emergence of diverse BI software. Furthermore, the capability of capturing and spreading very detailed transactional data has upgraded this discipline.

People play a crucial role because they are the ones who create knowledge. The information obtained from data via BI would be useless without actual people making decisions from it.

Finally, there are cultural aspects about a company that make implementing the studied discipline easier. The businesses that tend to be more successful in introducing BI are those that offer easy and broad access to information, encourage thorough analysis and decision-making, advocate for the distribution of findings to bigger audiences, require factual and rational support for plans and, lastly, promote experimentation while valuing learning from failures [2]

2.1.2. BI perspectives

Business Intelligence can be looked at from three different perspectives.

The first one is through its main goal: making better decisions faster. This implies improving decision-making across all levels, not only in upper management.

The next one focuses on converting data into information. This second point of view centres on trying to close the gap between data and valuable insight for the company.

Here, Key Performance indicators (KPIs) play a key role as they are used to report the corporation's relevant significant metrics.

Finally, there is the BI attitude which advocates for using a rational approach to management. It is characterized by pursuing quantifiable data related to business, employing structured techniques and tools to analyse it, developing models that explain the relationship between operational decisions and their impact on achieving objectives, exploring different strategies and monitoring the reactions on results, acknowledging the irrationality of people and, lastly, managing the business based on the characteristics mentioned in this paragraph [2]

2.1.3. BI cycle

A concept that is crucial to understand Business Intelligence is the BI cycle. This approach summarises the progression between analysis, insight, action and measurement, as can be seen in Figure 1.

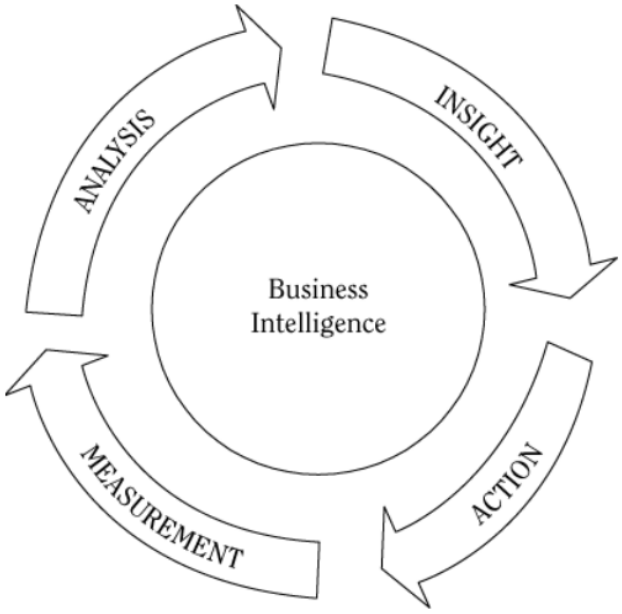


Figure 1. BI cycle representation

Source: Taken from Chapter 1 from "Business Intelligence" by Elizabeth Vitt [2]

The analysis step involves quickly asking and answering questions. Thanks to it, good questions can be found which leads to the following stage, insight. As stated in Elizabeth Vitt's Business Intelligence book [2] "Insight is the product of broad, free-ranging analysis born of questions that only we human beings can ask—the discovery of patterns that only humans can recognize as useful". The action period is reached through the decision-making process. After it comes the measurement, which allows to benchmark the performance and effectiveness of the actions taken.

2.1.4. BI applications

When developing a BI application, which represents any object (report, dashboard…) that is supposed to be delivered, it is crucial to specify its content. Some of the information that should be identified is an identifier, a name, a description, the category, the business processes supported by the application, the business transformations for the data and the analysis and the BI owner and developer. Moreover, information about the data such as the sources, structure and column names and data type, should also be added. This report is usually done in a spreadsheet, but it can also take the form a document.

The creation of this content specification files enables the revision of the BI applications. To review the list of objects, it is essential to start by assessing the scope of each one, once it is clear, a refinement of the list can be done. After the first filtering, the consolidated roster should be evaluated by the stakeholders. As a result, and agreed-upon deliverable list is obtained, which opens the door for the data modelling and integration [1].

2.1.5. The role of data

As it can be extracted from the previous topics in this section, data has a very important function in Business Intelligence.

It usually captures the details of the daily transactions at each operating system of a company. This asset is normally stored in data warehouses that feed from or into subject-specific sources also known as data marts. There are some characteristics regarding how they keep business data that every corporation should consider when building their warehouse. It should be subject oriented, as well as contain consistent, cleansed and historical data that is delivered quickly.

When the data wants to be made available and user-friendly, front-end tools are used. In BI, these engines are often used for presenting reports and interactive views, such as dashboards. Nowadays, there is a wide variety of platforms to choose from when designing BI systems. The right fit for each company depends on their goals and specific needs [2]. Some examples of said software category are the ones analysed in Chapter 3 of this project.

2.2. Evolution of BI

Before the term Business Intelligence was even mentioned, there were rulers, bankers and commanders who used strategic knowledge to make decisions, the same principle that now governs BI.

The first time that the expression comes into the surface, is in 1958 by Hans Peter Luhn, considered now as the father of the discipline. For him, a BI system was an automated procedure designed to distribute information to different parts of any organisation.

After the first definition, it started what is known as BI 1.0. During this phase, the development of data warehouses reduced the access time needed to get data. Moreover, in the 90s, Extract, Transform, Load (ETL) tools and Online Analytical

Processing (OLAP) software were conceived. OLAP is a tool that allows companies to study specific business drivers by formulating factual or descriptive questions [3]. Throughout this stage, Business Intelligence focused on producing data and reports and presenting it in an attractive and organized way. The main inconvenient during this period was that the tools were not intuitive and non-expert friendly, which delayed the delivery of reports.

When 21st century began, BI 2.0 also started. With it, real-time processing and self-service technologies started to emerge. The first enabled companies to make decisions using the latest available information, while the second allowed users without expertise to manage the tools available. Furthermore, these advances were empowered and supported by the rapid growth of the Internet. This facilitated the creation of web applications for BI, which are also available on mobile devices.

Nowadays, it is the turn of BI 3.0. This phase is characterized by collaboration and user-friendly platforms. Some of the developments that are being worked on are the push for cloud-base solutions and the implementation of machine learning and artificial intelligence, two fields that are undergoing relentless evolution [4].

2.3. Relationship with ML and AI

As mentioned above, Machine Learning (ML) and Artificial Intelligence (AI) are experiencing an exponential growth, especially in their use and research. One of the disciplines in which they are highly valuable is Business Intelligence.

The quality that makes ML algorithms special is the fact that they acquire knowledge from data without requiring explicit programming. With machine learning, historical data can be studied to identify correlations, analyse complex patterns and trends, as well as making predictions and recommendations. This can help organizations optimizing their supply chain management, and more specifically their inventory levels and the allocation of resources. Moreover, it can also benefit them by predicting demand patterns and identifying market fluctuations and seasonal trends, which allows them to develop strategies that line up with the market situation [5].

Other great service of Machine Learning is the ability to detect anomalies or outliers. This is a field that is being thoroughly investigated. For instance, in [6] the authors analyse the ML approach for detecting data deviations by using Supporting Vector Machines (SVM) or Neural networks combined with clustering. The identification of inconsistencies can assist companies to detect fraud patterns and suspicious activities, which aids them avoiding risks and losses [5].

AI systems are created to simulate human intelligence, therefore enabling computers to make decisions by themselves [7]. With this discipline come techniques such as Natural Language Processing (NLP) and computer vision. These methods open the possibility of using unstructured data sources such as images and videos to extract information, thus increasing the quantity of data to work with.

To be more specific, chatbots and virtual assistants powered by Artificial Intelligence, use NLP technology to process and answer user queries. This ensures that customers receive assistance any time, leading to increased satisfaction and decreased response

time. Furthermore, when combined with ML, the responses can be improved thanks to the algorithms learning from the data. This not only frees resources but also allows corporations to provide product suggestions, and personalized recommendations and solutions.

3. Business Intelligence tools

Nowadays, there is a great variety of vendors that offer Business Intelligence solutions. This section is going to be focused on the analysis and comparison of three tools: SAP Analytics Cloud (SAC), SAP Analysis for Microsoft Office (A4O) and Microsoft Power BI.

The reason behind the election of these platforms is tied to the company that has supplied the data for the development of the dashboard in Chapter 4. Said business uses the chosen software for their BI system and need a uniform guideline to orientate the users to select the best fit depending on what data they are working with and which are their goals.

3.1. Company context

Before diving into the actual comparison of the tools, is important to understand and explain some context of the company that is relevant to choose the software and for the description of variables in Section 4.3.2.

The corporation that has provided the data and collaborated to the elaboration of this project is a production company that operates on an international scale specializing in the manufacturing of insulation products. They primarily engage in B2B (Business to Business) sales, where they supply their products to other businesses and manufacturers. However, they also serve to B2C (Business to Customers) markets, where they sell directly to individual customers or end users.

For the software comparison, it is crucial to understand the infrastructure that the organization uses for storing and accessing the data, and how it is connected to the front-end platforms.

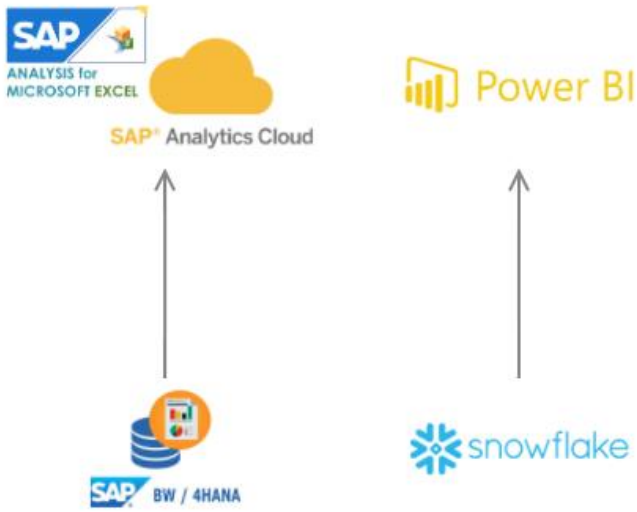


Figure 2. Current data and front-end tools infrastructure in the company

Source: Own elaboration

As it can be seen above in Figure 2, SAC and A4O get their data from a SAP Business Warehouse (BW) while Power BI gets it from Snowflake warehouses.

In the SAP BW there is mostly structured data related to factories, costumer relations and human resources. However, about 90% of the data is related to finance details such as sales and production. This data is used to support the creation of reports.

On the other hand, Snowflake is used to store raw and unstructured data, some of which is already stored in SAP. In addition, it includes data obtained from their e-commerce platforms and social media channels. This warehouse allows the creation of more complex reports and analysis, where data scientists can really exploit the data available.

Nowadays, there is and increasing interest from the business units in the use of Power BI, but there is some data available in the SAP BW that cannot be accessed through Snowflake. This results in many users manually extracting the data they need, creating applications over which the organisation has no control and no way of supporting. Mainly for this reason, the company is now working on changing the infrastructure to create an integrated data ecosystem and connect their warehouses. The new framework would look like the one shown in Figure 3.

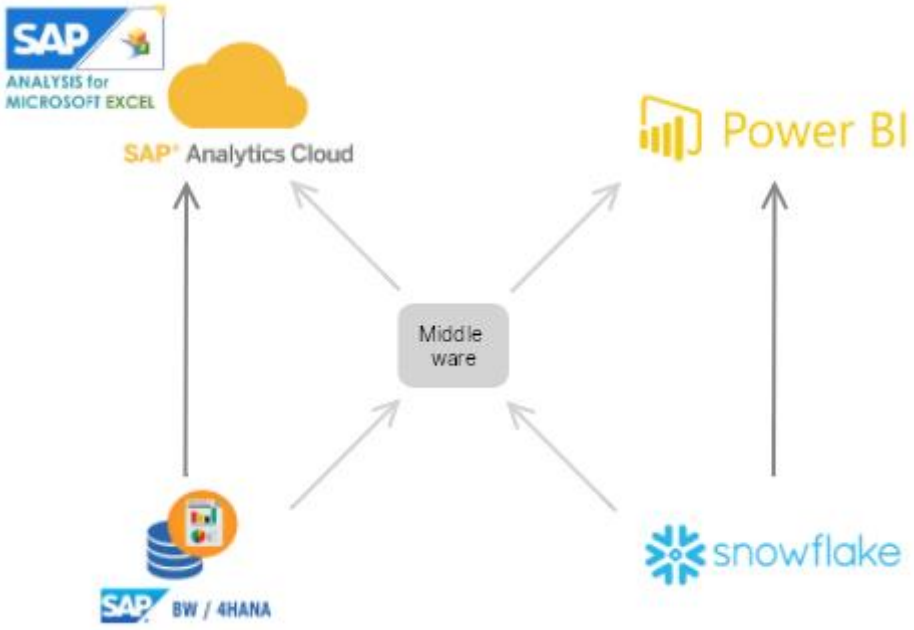


Figure 3. Future data and front-end tools infrastructure in the company

Source: Own elaboration

3.2. Methodology

To develop the comparison and resulting guideline, several aspects will be taken into consideration. Some of the characteristics that are going to be studied are:

- Type of applications that can be built
- Data that the developer would have access to

- Visualization options that the tool offers
- Possibility of transforming and relating the data
- Availability of the software on different devices
- Planning and sharing capabilities

These will be assessed based on general information of the tools and specific details about the company, making the guideline a tool mainly oriented to use within the enterprise. It will be helpful for new employees to get insight on the organisation and the best practices when working with the business intelligence software. It can be convenient for those that are starting a new project and do not know which tool fits best their requirements and necessities. Moreover, when the changes in the infrastructure are implemented, the guideline will be practical to better understand which platform to use independently of the data available.

3.3. Comparison

In this section, the three front-end tools will be defined and compared starting with the one that was introduced first. For it, different characteristics are going to be listed based on was mentioned in Section 3.2.

3.3.1. SAP Analysis for Microsoft Office

SAP Analysis for Microsoft Office is a Microsoft excel add-in that enables multidimensional analysis of data sources from SAP.

The data is shown in the workbook in crosstabs and, by using the design panel, the displayed data can be changed and analysed. Moreover, filters, prompts, calculations and charts can be added [8].

Regarding the characteristics for the comparison, these are the relevant features:

- ***Type of Data***

  As mentioned in Section 3.1, A4O is implemented on top of the SAP Warehouse. This means that the data that can be used is structured and mostly related to finance, which includes sales and production information among others. In addition, there is also factory as well as customer and human relations data.

- ***Data manipulation***

  This tool does not offer data modelling options and the data blending options are very limited. However, as it is embedded in Excel, formulas can be used, which means that more insight can be extracted from the data.

- ***Type of applications***

  In the company, Analysis for Office is mainly used for reporting, without including complex visualizations. Moreover, sometimes it is used for checking data or as a template for more sophisticated charts and reports developed with other tools.

- ***Type of visualizations***

  A4O has limited visualizations, only those already available in Excel. Furthermore, the customisation is also restricted mainly to choosing the colours.

- ***Device availability***

  This tool is exclusively designed for use on the desktop version of Excel. As a result, there are some features of the Microsoft environment that are not available. An example of this is the autosave option.

- ***Planning and sharing***

  This front-end tool includes planning capabilities, but sharing is more complicated as the software is only available for desktop Excel. Furthermore, reports can be scheduled to be published.

- ***Other***

  Finally, there are other features that can be highlighted such as the Microsoft Power Point add in that allows to share reports with others via presentations. Moreover, fields can be added by simple drag and drop, which makes the development easier and more flexible.

3.3.2. SAP Analytics Cloud

SAP Analytics Cloud, more commonly known as SAC, is a cloud solution that merges BI, augmented and predictive analytics and enterprise planning in a single system [9].

For the comparison, these are the key features to focus on:

- ***Type of Data***

  As it happens with Analysis for Office, with SAC there is only access to the SAP BW. This means that the applications made with this software mainly use finance, factory, costumer or human relations data.

- ***Data manipulation***

  This platform offers option for both data modelling and blending. However, the choices of connectors for relating data are very limited. As a result, working with more than two or three data models can be difficult and also makes applications perform worse.

- ***Type of applications***

  With SAC, both reports and dashboards can be built. As mentioned in A4O's section, sometimes it is used for giving more interactivity to reports developed with Analysis for Office.

- ***Type of visualizations***

  Regarding the visualizations options, SAC offers more than the previous tool studied but it still has limited possibilities. Apart from the classical bar, line and pie charts also available in A4O, plots that automatically offer forecasts and KPI indicators can be added. Moreover, some programming languages such as Java can be used to add more customization into the plots.

- ***Device availability***

  SAC only has a web-based version, which makes it impossible to work with it without a continuous connection to the Internet. However, this software has more possibilities in relation to the readiness in other devices different from a computer, as it is viable to view stories from a phone. Furthermore, when building an application, it can be developed from a scalable option, which allows the visualizations to be adapted to different device sizes.

- ***Planning and sharing***

  This tool offers different options for planning and sharing as well as for scheduling and alerting. However, if more than one user is editing a story at the same time, conflicts tend to emerge, which makes collaborating a tedious task.

- ***Other***

  With respect to other characteristics that may be relevant to consider, SAC does not have add-ins for neither Power Point nor Excel. On other topic, the applications built with this tool are the most easily supported by the BI team. Finally, feedback on the visualizations can be easily received and given as comments can be added on the stories.

3.3.3. Microsoft Power BI

Power BI is a Business Intelligence platform from Microsoft that allows you to connect data sources and turn them into coherent and interactive visuals [10].

- ***Type of Data***

  The use of Power BI with the company's infrastructure as it is now, introduces the ability to work with unstructured data related to, not only finance, customer and human relations, but also to social media channels and e-commerce.

- ***Data manipulation***

  This platform is the one that involves better tools for data modelling and blending with a full scope of data connectors. Furthermore, DAX language can be used for data aggregation and manipulation. However, the fact that a lot of data can be related, may make the program to take longer time processing.

- ***Type of applications***

  As it happened with SAC, Microsoft's BI software can be used to build both dashboards and reports.

- ***Type of visualizations***

  In connection with the types of charts offered, this tool does not only have the predefined options, but it also has many certified visualizations certified by Microsoft that can be easily downloaded and added to the platform. Moreover, programming languages such as Java, R and Python can be used for customization.

- ***Device availability***

  Power BI has phone, desktop and web-based options, so it can be used both online and offline. In addition, the mobile development is easier than with SAC as reports and dashboards can be built employing a specific view that allows designers to visualize how the charts would actually look on a phone.

- ***Planning and sharing***

  Same as with SAC, Power BI has planning, sharing, scheduling and alerting capabilities. Furthermore, collaborating is also difficult as conflicts happen when more than one user is editing a story.

- ***Other***

  Other aspect to take into account about Power BI, is the embedding in the Microsoft ecosystem. Applications done with this front-end tool can be simply incorporated in Power Apps or SharePoint which makes it easy to publish for the company, as its Intranet is mainly built using those platforms. Also, there are add-ins for Excel and Power Point, which make it possible to add plots to presentations and workbooks. Moreover, the commenting feature is implemented, which allows receiving and giving feedback.

3.4. Results

Once the relevant features of the different front-end tools have been studied, a guideline can be created.

As it can be seen in Figure 4, it was decided to make the guideline by designing a schema. The chart is divided into topics, the same way the comparison is. By employing diverse colours to differentiate them, it is easier for the users to identify which features each tool has. Thanks to it, once a developer knows the requisites that a project needs, they can look into the guideline and choose the best fit for it.

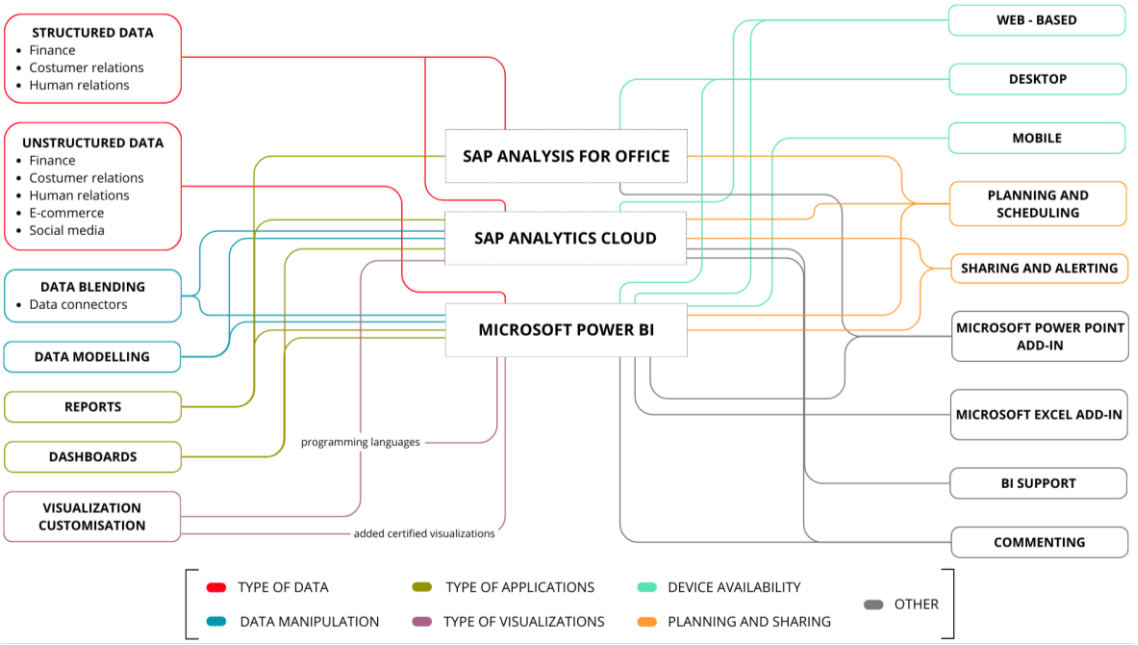


Figure 4. Guideline to choose a front-end tool

Source: Own elaboration

4. Creation of a visualization tool

In this chapter the process of design and creation of the visualization tool named “Daily Management Dashboard” is explored, covering everything from the data acquisition until the final implementation.

The Daily Management Dashboard is a tool that mainly focuses on sales data, which is updated daily by the company. It allows upper management, especially the CFO, to make decisions based on real-time insights.

The project was conceived by the Business Intelligence team manager and the CFO. It arose from the necessity of creating a tool that provides easy access to data, allowing them to gain insights into the sales situation and its evolution. Previously, the way of showing sales information was by generating PDF reports based on A4O crosstabs which, although automated and updated as frequently as the dashboard, are not as intuitive and the comparison of results is complicated.

To sum up, the new tool serves as an interactive viewer that allows data to be displayed in a clear and orderly manner. Instead of the old PDF reports, users can explore the data in a more dynamic way. In addition, it will also function as a practical case to continue with the comparison of the different front-end software used by the company.

4.1. Goal of the visualization tool

The main objective of the tool is to provide the company’s CFO with a BI solution that allows him to visualize financial data. He wants to be able to easily check different parts of the business in the same application.

To accomplish this target, some specific goals should be achieved:

- Show daily information in a simple way
- Display weekly details
- Provide an overview of the entire month

If these goals are accomplished, the user will be capable of analysing and comparing their sales data on different time intervals.

4.2. Choice of software

Following with Section 3.3, the creation of the visualization tool will serve not only for displaying financial data but also as a practical case to continue comparing the software.

Since the main target of the application is to visualize data in a simple and efficient way, only two of the three available platforms are going to be used. The selected tools include SAP Analytics Cloud (SAC) and Microsoft Power BI Desktop. Specifically, the dashboards were created using SAC version 2024.8.7 and Power BI Desktop version 2.128.1380.0. Additionally, for the latter tool, a free license was utilized while the only option for SAC is to pay for its use.

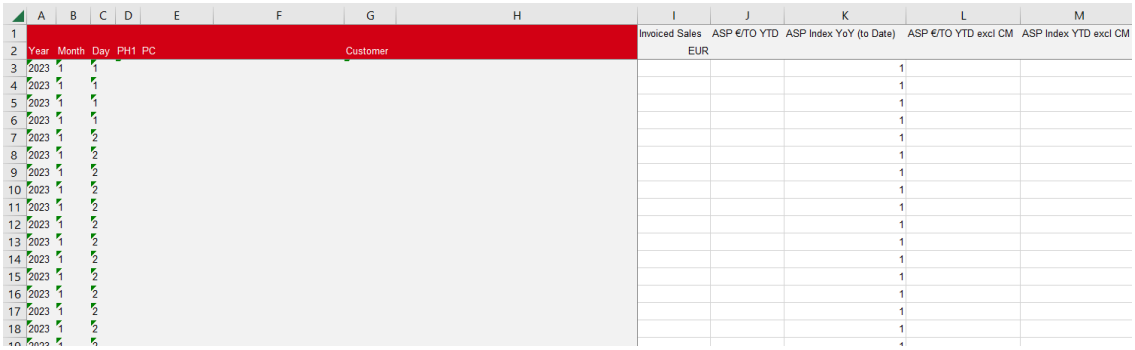
4.3. Data description

4.3.1. Data sources

As mentioned in Section 3.1, due to the difficulties derived from the current data infrastructure of the company, some of the data is not equally available for both front-end tools. For this reason, two different data structures are used to feed the dashboards.

The first one is a data model built using SAC modeller. This tool enables developers to create, view, and configure models for various use cases within the SAP owned software [11]. Since this structure was already built when the project started, the second data construction was based on this.

Considering the variables in the model, a data extraction was set up using an Analysis for Office report, which looks like the table shown in Figure 5 where some information has been hidden due to data privacy. How this extract was obtained is explained with further detail in Section 4.5.



	A	B	C	D	E	F	G	H	I	J	K	L	M
1									Invoiced Sales	ASP €/TO YTD	ASP Index YoY (to Date)	ASP €/TO YTD excl CM	ASP Index YTD excl CM
2	Year	Month	Day	PH1	PC		Customer		EUR				
3	2023	1	1								1		
4	2023	1	1								1		
5	2023	1	1								1		
6	2023	1	1								1		
7	2023	1	2								1		
8	2023	1	2								1		
9	2023	1	2								1		
10	2023	1	2								1		
11	2023	1	2								1		
12	2023	1	2								1		
13	2023	1	2								1		
14	2023	1	2								1		
15	2023	1	2								1		
16	2023	1	2								1		
17	2023	1	2								1		
18	2023	1	2								1		

Figure 5. Fragment of the A4O report

Source: Own elaboration. Some data has been hidden due to data privacy.

As it can be seen in the above figure, an A4O report has a similar structure to the classic Excel sheets. This allows the report to be downloaded into an .xlsx file enabling to load said data into Power BI.

It is important to highlight that, even though the structures are different based on the front-end tool in use, the data originates from the same source. Consequently, the same numerical results are expected in both displays.

4.3.2. Variable description

From this section on, the variables will be classified into metrics and dimensions because this is how they are differentiated in the company and in the analytics field. The metrics are usually numerical variables while the dimensions tend to be categorical.

Inside the dimensions group we have:

- **Date:** Groups day, month and year which can also be found as separate dimensions
- **PC:** Profit centre

- **Customer:** Shops or individuals who have placed an order
- **PH1:** Less detailed level of the company's product hierarchy

The metrics can be categorized into five groups: Order Intake, Open Orders, Invoiced Sales, I+O, and ASP, which is an abbreviation from Average Sales Price. The first four categories are closely interconnected.

Specifically, when an order is received it becomes part of Order Intake and Open Orders. The main difference between these categories is that Order Intake is the sum of all received orders from customers while Open Orders only includes those that have not been invoiced yet. When an order (or item) is delivered, it is removed from Open Orders and is included in Invoiced Sales instead. Moreover, these metrics are evaluated based on different dates. Order Intake shows results based on the date when the order was created, Open Orders is reported per requested or expected delivery date and Invoiced Sales uses the billing date. For instance, looking at the data for one month, Order Intake represents the total orders that have been created that month, Open Orders shows the orders with a delivery date in that month and Invoiced sales includes the orders that have been invoiced in said month. Finally, I+O represents the total of Invoiced Sales and Open Orders.

Before diving into a more detailed explanation of the metrics, some acronyms need to be clarified. First, we have those that are related to time intervals:

- CY: Current Year
- LY: Last Year
- MTD: Month to Date
- YTD: Year to Date
- CM: Current Month
- YoY: Year over Year

In addition, the abbreviation "Cum" is used to talk about accumulated metrics and "excl" denotes excluding.

An overview of the metrics can be found in Table 1.

Table 1. Summary of metrics by category

Order Intake	***Invoiced Sales***	***Open Orders***	***I+O***	***ASP***
2 days ago	2 days ago	Cum CM	Cum CM LY	Index MTD
Yesterday	Yesterday	CM	Cum CY	Index YoY (to date)
Last 7 days	Last 7 days	CY	CUM LY	Index YTD excl CM
7 days average	7 days average	Upcoming	LY	€/TO YTD
7-14 days ago	7-14 days ago			€/TO excl CM
30 days	30 days			MTD
30 days average	30 days average			

30 days LY	MTD			
MTD	MTD LY			
MTD LY	Cum CM			
YTD excl Cm	CY			

Source: Own elaboration

The metrics of the first four categories can be found in both euros and tons. The monetary ones are indicated by using the euro symbol (€) and the weight related ones are referenced with TO or by simply adding “tons” to the name.

When the term “index” appears in the context of ASP metrics, it references a variable that compares the current year to the previous year. Finally, if the symbol €/TO is present in the name, it indicates that the measurement pertains to the price per tonne.

4.4. Initial design proposal

After initial meetings with the BI team manager, the first step was to create a draft to begin with the design proposal. One of the first aspects that were addressed was studying other dashboards developed within the company to gain insights of the classic structure, colour palette and visual elements. Furthermore, the goals and public of the product were also analysed. After this process, it was decided that the tool should prioritize usability. It should be intuitive, visually appealing, and efficient, ensuring that users can quickly retrieve the relevant information they need.

Regarding the structure of the dashboard, most of stories already available within the company follow a similar pattern. This configuration starts with an overview page that acts as a summary, where the most important information is displayed. Some of the charts may be repeated in following pages, where more detailed plots can be found. Following with this format, the first design for the dashboard page configuration can be found in Figure 6.

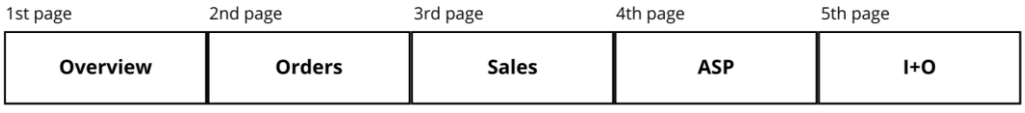


Figure 6. Initial structure of pages in the dashboard

Source: Own elaboration

As it can be seen, not only other dashboards but also the metrics categories described in Section 4.3.2 were considered to create the structure. Minor changes into the categories were introduced after further examination of the data, which results in the display of Open orders and Order intake variables on the same page named “Orders”.

Once the distribution of sections was set, it was time to decide the configuration of charts within a page. For it, the analysis of other dashboards was also used. It was determined that the best way to keep the visualization tool uniform and easy to understand was to follow the same plot structure when possible. The first design of the composition can be found in Figure 7.

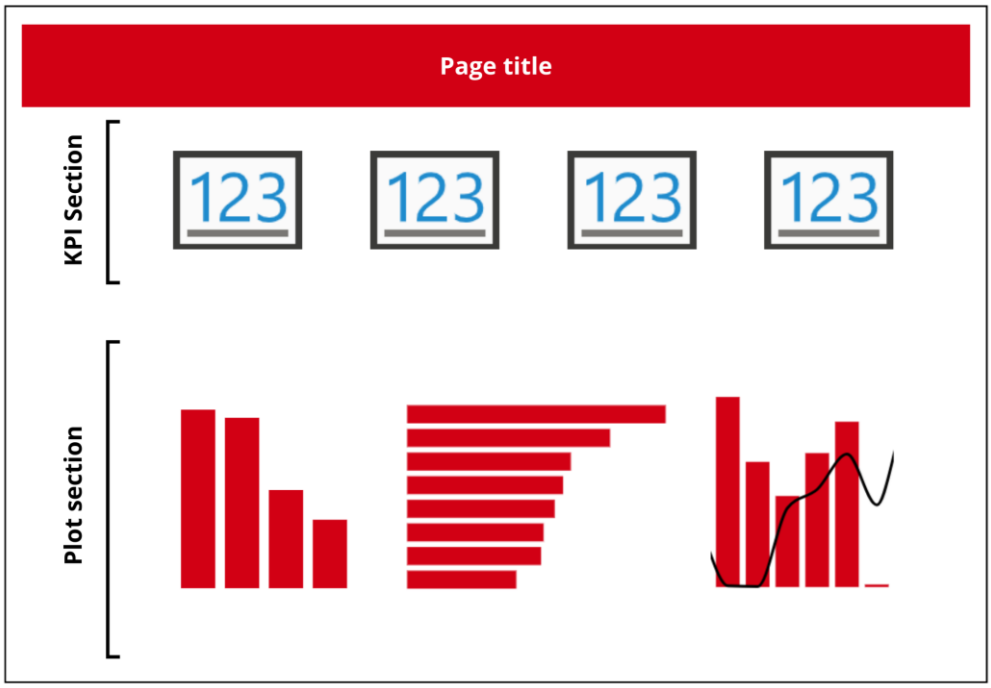


Figure 7. Initial distribution of plots in a page

Source: Own elaboration

As shown in the previous image, there are two visual elements that predominate in the dashboard design. Those are:

- **Numerical cards:** to display numerical data in a straight-forward way. It will be used to show general numbers like yesterday's sales and orders.
- **Column/Bar charts:** they have two main purposes. The first one is to show the evolution of a metric within a specific time interval which will normally be a month. The second use will be to compare the values of a metric depending on a dimension. For example, the Order Intake MTD split by PH1. This type of plot will be also combined with a line plot to contrast current year to last year values.

Another thing that was carefully studied when developing the initial design of the dashboard was the colour palette. To create it, the colours of the company were studied. Notably, dark red is prominently featured in the brand identity. This posed a challenge because, in the realm of visualization, it is typically associated with negative connotations. To mitigate this, red was used as the main colour in all graphics, combined with black when additional information needs to be added. To make positive or negative connotations, the chosen colours where green and a more muted red respectively. By using a different shade of red, the aim is to differentiate between its use to represent

negativity and its use as the main colour. A more detailed explanation of the palette can be found in Figure 8.

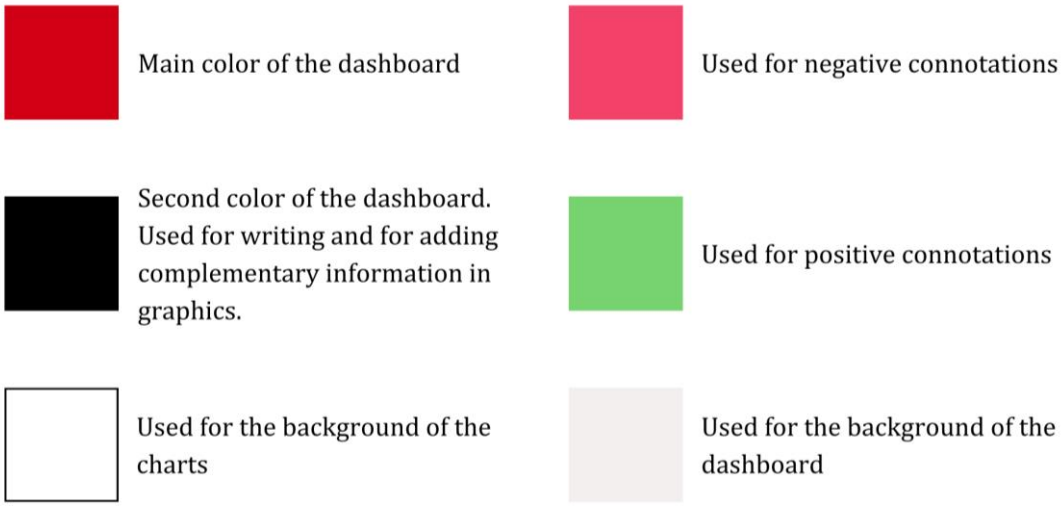


Figure 8. Initial colour palette of the dashboard

Source: Own elaboration

4.5. Methodology of tool development

4.5.1. Data acquisition

The first step for building the application was to acquire the data to be displayed. As explained in Section 4.3.1, each of the front-end tools gets the information from a different data structure. Since the data model used for SAC was already built, it was easily connected to the respective dashboard. However, getting the data for Power BI was a more difficult task that involved developers and data experts of the company.

Given the current limitations making impossible the direct connection of SAC models to Power BI within the organization, a data extraction had to be done. To accomplish this, the chosen approach involved creating an A4O report. The initial step involved identifying the correct data source, which was achieved by accessing the model information.

Once the source was identified, the next objective that had to be met was to make the extract as similar as possible as the structure that feeds the SAC dashboard. A study of the metrics and dimensions had to be done to ensure that both tools had access to the same information. After it, the variables were chosen by using the display panel available in Analysis for Office. This required various iterations as the developers had to add new metrics in the data source while the dashboard was already being built.

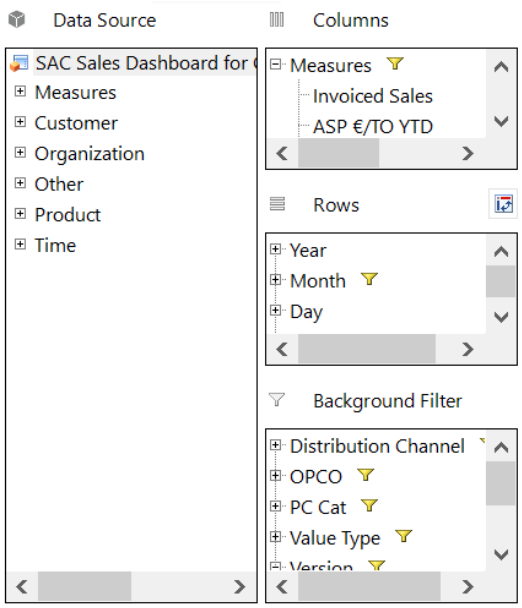


Figure 9. Display panel A4O report

Source: Own elaboration

As it can be seen in Figure 9, there are several background filters applied to the report. The most relevant for this specific data extract is OPCO, which is translated into operating company. This filter was implemented to restrict the report size due to limitations on data downloads. In addition, it was also added as a measure to ensure data privacy when publishing this project. Due to the file size limitations for downloading, only data for the first five months were downloaded for two consecutive years.

After building the report, it was downloaded in .xlsx format and connected to the dashboard created in power BI. To make sure that the BI application receives the latest data, first the data source in the A4O report must be refreshed and then the same has to be done in Power BI. This does not happen when using SAC because the model is automatically updated daily.

4.5.2. Dashboard development

Regarding the development of the BI application, the first dashboard that was created was the one built with SAC. This decision was made based on the availability of the data, mainly because the production of the data extract for Power BI took more time and resources than expected. Furthermore, it was considered that since SAC is the most widely used tool within the company and, consequently, the benchmark to overcome, it would be interesting to employ it as a template and trying to improve it using Power BI. This approach will also facilitate the comparison between the two tools.

During the elaboration of the SAC dashboard, there were some changes made to the initial design. The first one was to change the general structure of the application. This choice was made considering that it would be more effective to distinguish between the measurements in euros and those in tons. Consequently, the decision was to separate them onto different pages to prevent overcrowding them, therefore adding more

pages. Upon closer inspection of the data, it was noted that the ASP information could be included on some other page. It was therefore included in the Sales page, and more specifically in Sales €. The final page configuration for SAC can be found in Figure 10. For Power BI, the configuration changes slightly because there were problems displaying ASP data and it was decided to not include it in the dashboard. The main issue was that the corresponding data could not be downloaded.

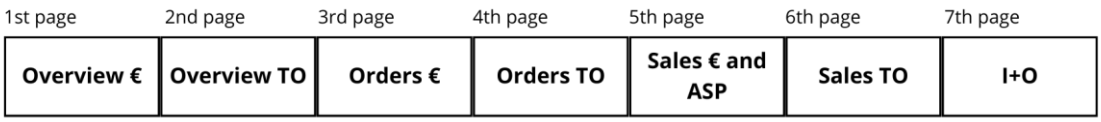


Figure 10. Final structure of pages in SAC dashboard

Source: Own elaboration

In addition, a new visual element was added to the initial selection to offer the user more detailed information about the average sales price in different countries. Specifically, the map that was built consists of three choropleth layers: ASP index MTD, ASP Index YoY (to date) and ASP €/TO YTD, in which the data is displayed by customer. The interesting thing about this plot is that more than one layer can be shown at the same time, which may be confusing for some users but helpful for others if they want to get ASP information combined. However, reproducing this chart in Power BI could not be achieved due to some problems with the type of data. The extract made available for Power BI only has the name and identification number of costumers and not the coordinates or exact location, which is needed to build a map in this tool.

Other changes in the structure, specifically within the chart configuration in the pages can be seen with more detail in the next section.

4.6. Results

In this section, the final results of the visualization tool developed with both SAC and Power BI will be displayed. In addition, differences and similarities found between the front-end software during the elaboration of this report will also be mentioned.

Only the pages with the information in € will be attached here, those that include the metrics in TO can be found in Appendix A.

Both Figure 11 and Figure 12 show the page correspondent to the overview in euros. In this section of the dashboard, the user can navigate through general information of the variables available.

In the top part, there are six KPIS for Order Intake and the same number for Invoiced Sales, displaying the same information but for the two different metrics. The top four numeric cards not only display the data for two days ago and yesterday, but also a comparison with the seven day and 30-day average, values which can be found in the

KPIs below. This additional information allows the user to quickly learn if the orders and sales have been above or under the average.

Furthermore, for Order Intake there is a plot that allows the viewer to learn about the evolution of orders in the last 30 days, while comparing them to the previous year. Finally, in the bottom right-hand corner there is a stacked column and line plot that shows the accumulated values for invoiced sales and open orders throughout the current month.

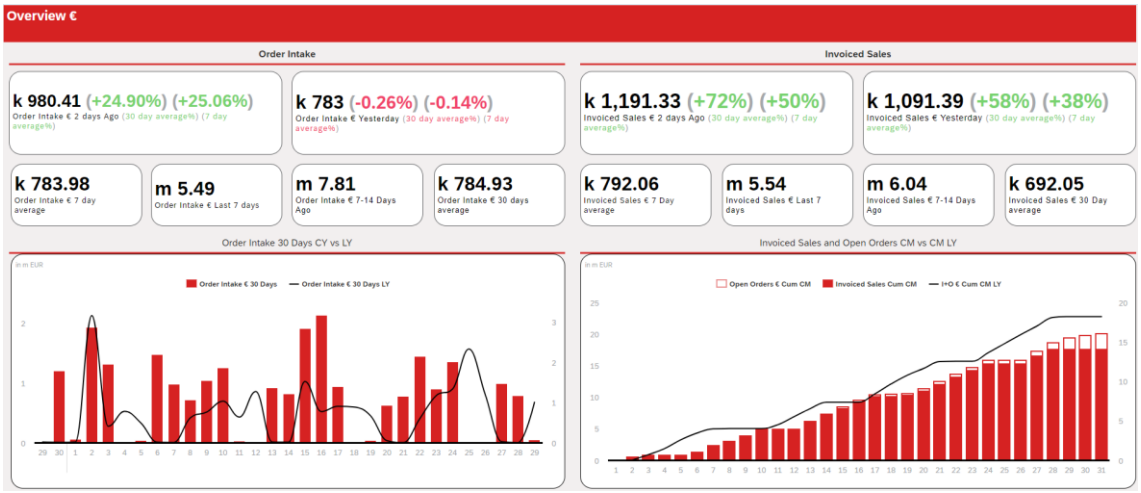


Figure 11. Screenshot of Overview € in SAC

Source: Own elaboration

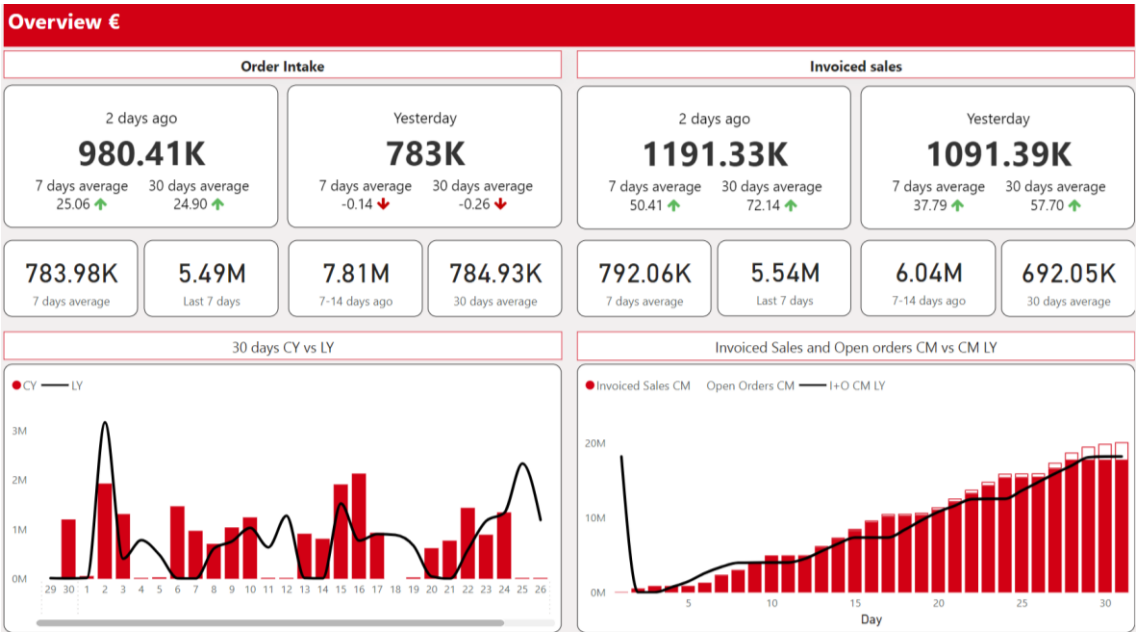


Figure 12. Screenshot of Overview € in Power BI

Source: Own elaboration

Even from just these two pictures, noticeable differences in the software can be appreciated.

One of these discrepancies is the format of the top KPIs. In SAC, the variance between two metrics can be automatically added to plots, but this option is not available for the other software. Therefore, for Power BI, a calculation had to be created to compare the desired variables and a new graph had to be found and downloaded to add this information. This was implemented with “Dynamic KPI Card by Sereviso” [12].

Other distinction between the tools is the axis when more than one metric is added to a plot. In SAC, it shows different axis, with different scales sometimes, which may give the user wrong information about the data. However, Power BI has the option of displaying all the metrics with the same axis.

The third difference that can be extracted from the figures is the renaming of measures. Power BI allows the developer to change the name of the variables depending on the chart. This allows for greater flexibility and customisation. In addition, in this project, this possibility has been used to reduce the amount of text and thus increase the uniformity and clarity of the graphs. In SAC, renaming a metric affects all charts in which it is used, so it was decided to keep the original names.

To end up with the overview, the position of the unit of the metrics in the KPI cards can also be an item of comparison. In SAP’s tool the unit is displayed before the number and there is no option to put it behind, which is the classic way to see it. As it can be seen, Power BI places it after the number.

In Figure 13 and Figure 14, the layout of the graphics on the Orders € page is shown. As it can be seen, there are six numeric cards. Some of them show information that was already in the overview page, but here there are also KPIs for the last 30 days and the Order Intake MTD.

In SAC, there are three new graphs showing a comparison between Order Intake MTD and Order Intake MTD LY categorised by PH1, PC and Customers from left to right. This is also present in the Power BI dashboard, but they do not have the previous year information due to data limitation. The same happens with the bottom right-hand plot, which could not be reproduced due to problems with the data. In its place the Microsoft tool has one more KPI displaying the open orders of the current month. The last chart is titled Order Intake CY and it shows the monthly evolution of the Order Intake. In the images, the details of the dimensions have been covered to protect private information of the company.

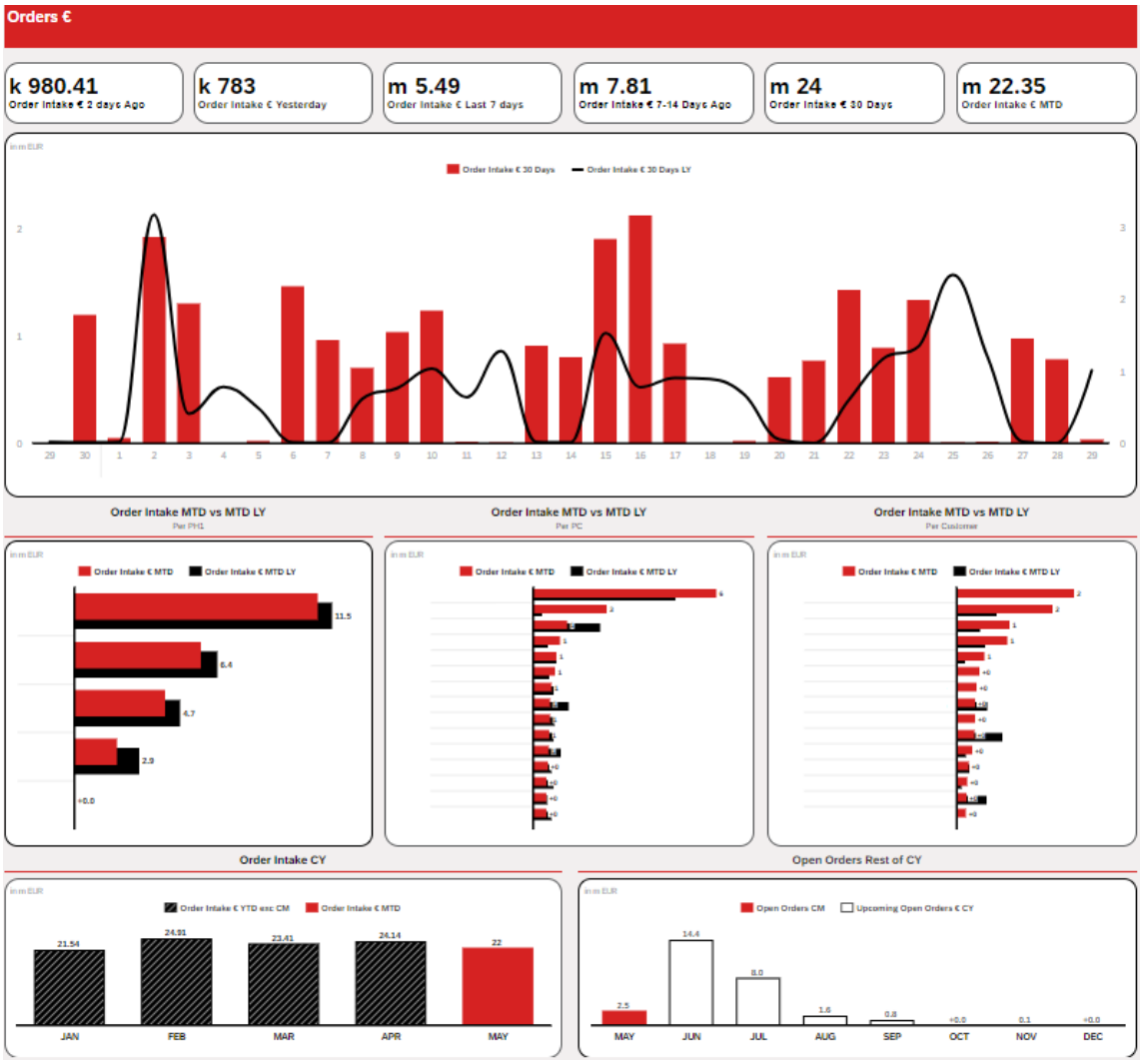


Figure 13. Screenshot of Orders € in SAC

Source: Own elaboration. Some data has been hidden due to data privacy.

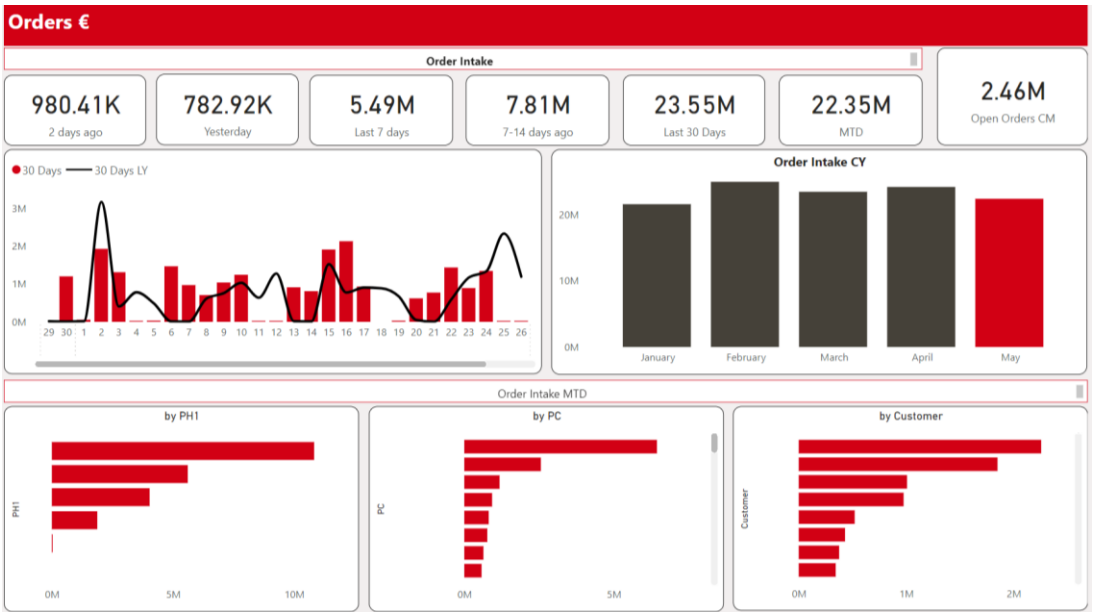


Figure 14. Screenshot of Orders € in Power BI

Source: Own elaboration. Some data has been hidden due to data privacy.

The next page of the dashboard can be seen in figures Figure 15, Figure 16 and Figure 17. The first and last one are built using the same structure as the order intake section on the previous page, but using Invoiced Sales € as the base metric.

The new information in this part of the application comes from the ASP variables. As mentioned in Section 4.5.2, a choropleth map was added to display three different metrics related to ASP data. In addition, there are two column charts by month up to the current date. The one at the top shows the ASP index and the one at the bottom shows the ASP €/TO.

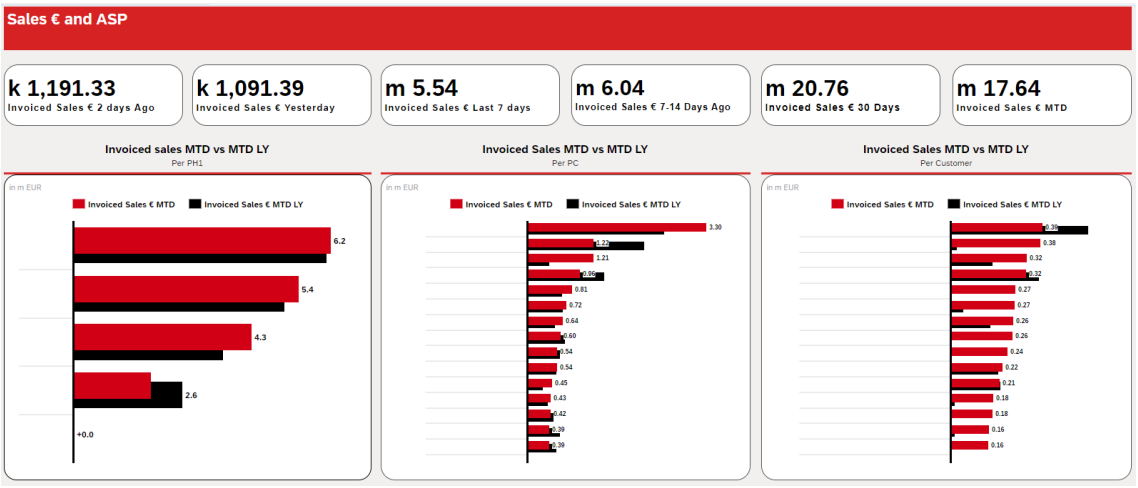


Figure 15. Screenshot of Sales € from Sales € and ASP page in SAC

Source: Own elaboration. Some data has been hidden due to data privacy.

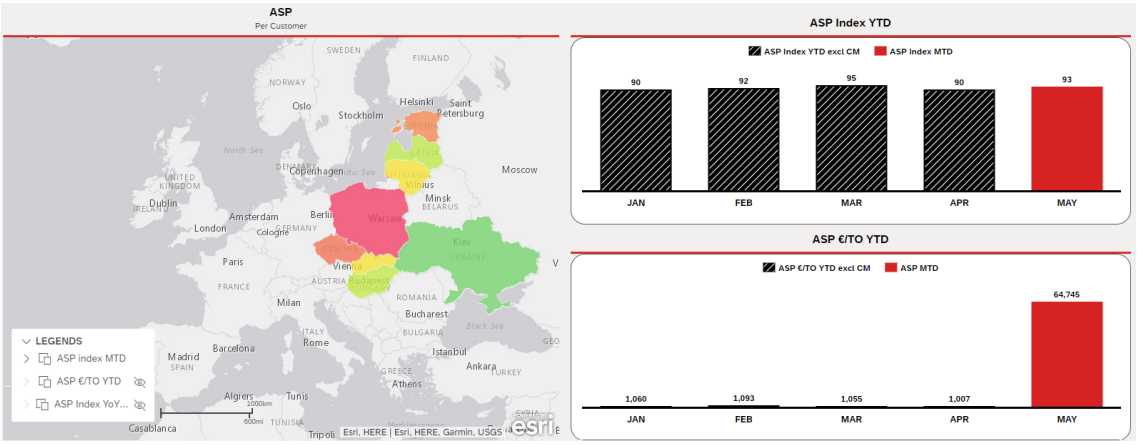


Figure 16. Screenshot of ASP from Sales € and ASP page in SAC

Source: Own elaboration

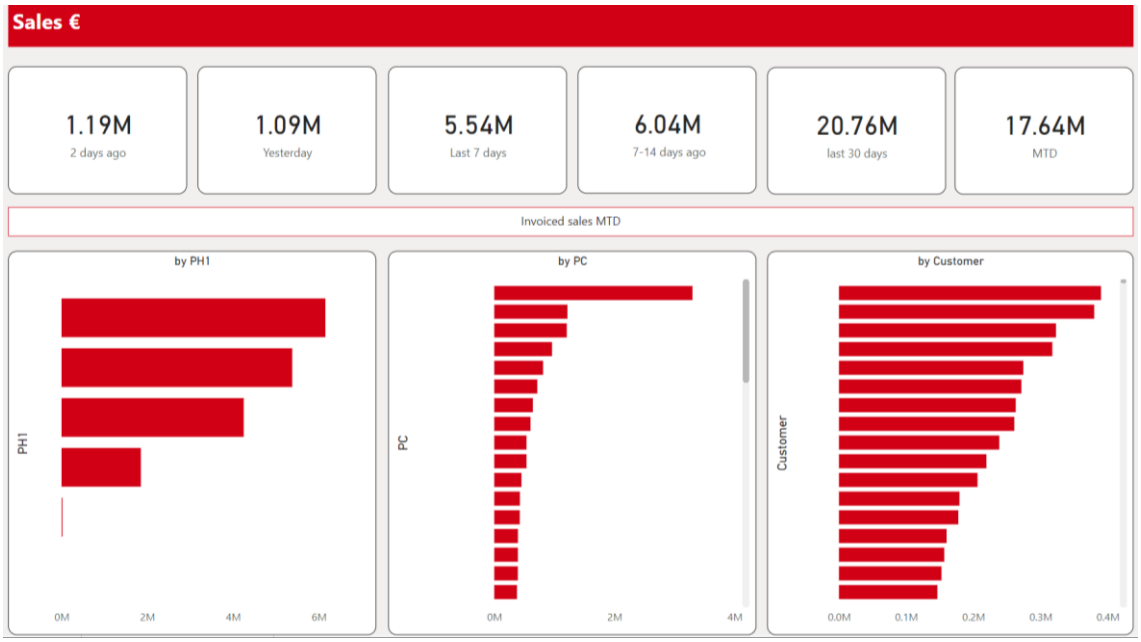


Figure 17. Screenshot of Sales € in Power BI

Source: Own elaboration. Some data has been hidden due to data privacy.

The last page of the dashboard can be found in figures Figure 18 and Figure 19. Since there are only three charts for each unit of measure, both € and TO can be seen in the same page. The two stacked columns and line charts can also be found in the correspondent overview page.

However, there also new plots in this part of the application. The first one displays the monthly Invoiced sales and Open Orders, and it compares them with the I+O of the previous year. With it, actual values can be seen. On the other hand, the other graph shows the accumulate I+O throughout the months for both the current and previous years.

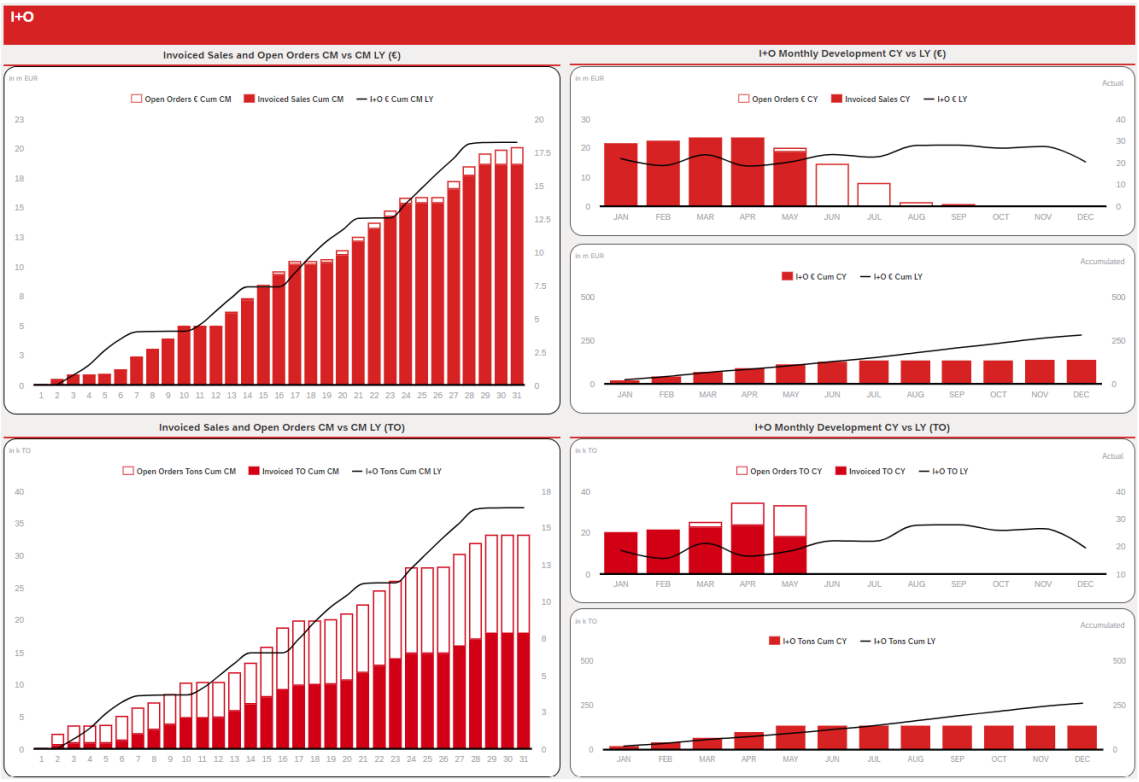


Figure 18. Screenshot of I+O in SAC

Source: Own elaboration

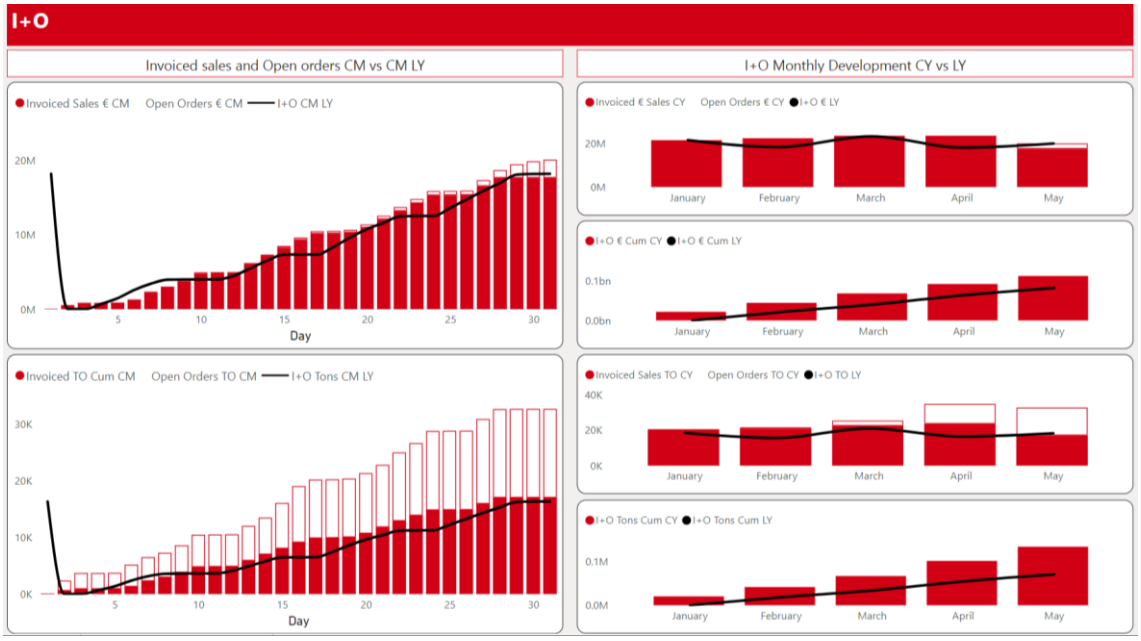


Figure 19. Screenshot of I+O in Power BI

Source: Own elaboration

4.7. Final remarks

To finish with this chapter, there are some other differences between the front-end tools that were found during the elaboration of the application but cannot be seen directly on the dashboard.

The first of these is the size of the pages. In SAC is unlimited in both length and width, which means that more graphics can fit on the same page than in Power BI, where there is a limited size. That is one of the reasons why the structure of the pages shown in figures Figure 13 and Figure 14 is different.

On another note, the creation of calculated metrics is more user-friendly when using SAP's software whereas Power BI relies on formulas with the same format as the ones used in Microsoft Excel.

Another aspect that differentiates the platforms is the fact that Power BI offers diverse possibilities for zooming in. The first one is selecting a single chart and clicking on "Focus mode". By doing that, the chosen graph is displayed on full screen, and it can be seen in detail. Alternatively, developers can choose to zoom in on the whole page, allowing precise alignment of all plots and fine-tuning other details.

Finally, with Microsoft's tool, the X-axis and Y-axis can be customized separately, which enables more personalization in the dashboards. This option is not available in SAC, where the changes are displayed in both axes.

5. Legal and ethical framework analysis

A key aspect to take into consideration in any project is the compliance with the legal and ethical framework in which it has been developed.

There are several preventive measures related to the use of data that are obligatory for any Data Science project. One of the most remarkable is the GDPR – General Data Protection Regulation.

This project has not involved sensitive personal data or data that had to undergo an anonymisation process. However, it is important for the company to reserve the right to privacy of its own data since it is one of their most valuable resources. Some of the measures taken to protect the data within the context of the development of this project have been:

- Do not share the name of the company to which the data belongs
- Hide the date in which the screenshots of the visualization tool screenshots were taken
- Mask the names of customers, products of PH1 and profit centres

In addition, the company itself also places limits on access to data and dashboards. For example, when someone wants to access a certain type of data, they have to request authorisation first, which has to be approved by more than one individual within the company.

6. Conclusions and legacy

In this last chapter of the project, the conclusions will be presented. With these, a review of the goals set and whether they have been achieved or not will be done. In addition, proposals for the improvement of the results, limitations found during their development and the legacy that comes from the elaboration of this project will be mentioned.

Firstly, the objective of creating a guide to help the employees of the company to navigate through the available Business Intelligence tools has been accomplished successfully. The study and comparison of technical characteristics of the software such as the devices where they can be used or the type of visual elements that can be built with them, together with more company-specific characteristics like the data that can be accessed and whether support can be received from the BI team, has enabled the creation of a guideline. Said product is built with the form of a conceptual map and uses diverse colours depending on the category of the characteristics, which makes it easier for the users to find the most appropriate tool depending on what their needs are. This guideline must be manually updated when changes in the company's data infrastructure are introduced or new features are added in the BI tools.

With regards to the second goal which main focus was to develop a visualization tool that allowed upper management and specially the CFO to get daily insights on the company, it can also be confirmed that it has been successfully achieved but not without limitations. The main constraint when developing said dashboard was the access to data with one of the chosen platforms, Power BI. However, most of the charts could be built on both dashboards.

If we look into the specific goals of this BI application, which can be summarised as the intention of displaying daily, weekly and monthly information, we can confirm that the former and the latter do have a strong presence in the dashboards, while the weekly information is rather more limited. As a result, the primary objective moving forward is to enhance this product by incorporating additional weekly information, such as the evolution of sales forecasts or orders. Additionally, other way of improving the results would be adding filters and interactive features between the graphs to create more dynamic dashboards with greater detail. Finally, it is relevant to mention that the BI application has received the approval of the Business Intelligence team manager but still has not yet been presented to the CFO, which could lead to changes compared to the final results presented in this thesis.

Regarding the legacy, there is three main added values to consider: guidance for employees, strategic insights and academic contribution. Thanks to the BI software guideline, employees will be able to make informed choices, potentially giving them more empowerment and freedom. In relation to the visualization tool, its legacy lies in strategic decision making and data driven actions, helping the company to shape and steer its trajectory. Lastly, beyond the corporation level, the thesis contributes to Business Intelligence tools knowledge by giving insights on strengths and weaknesses of some of the most common used platforms.

To sum up, although the two objectives set at the beginning of this project have been achieved, there is still room for improvement in both the guideline and dashboards presented. Moreover, the legacy of this project lies not only in the products, but also in the knowledge shared and the potential for advancements in BI.

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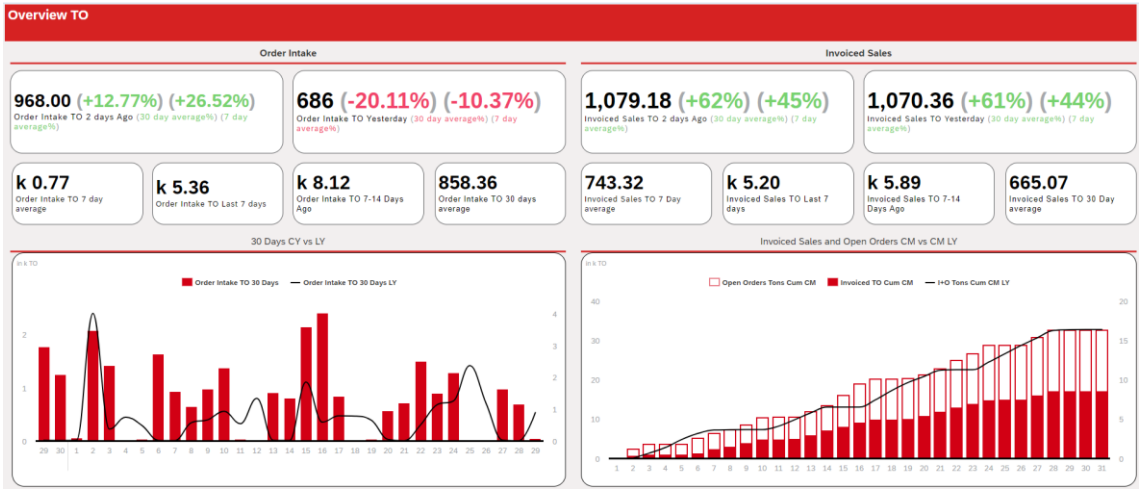
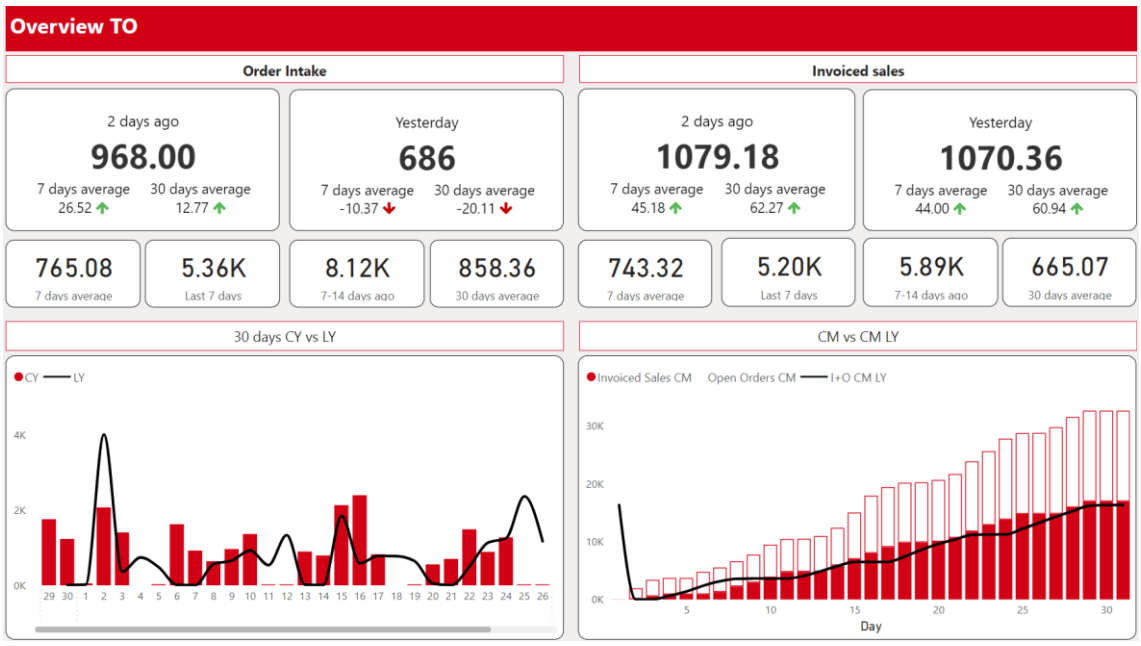
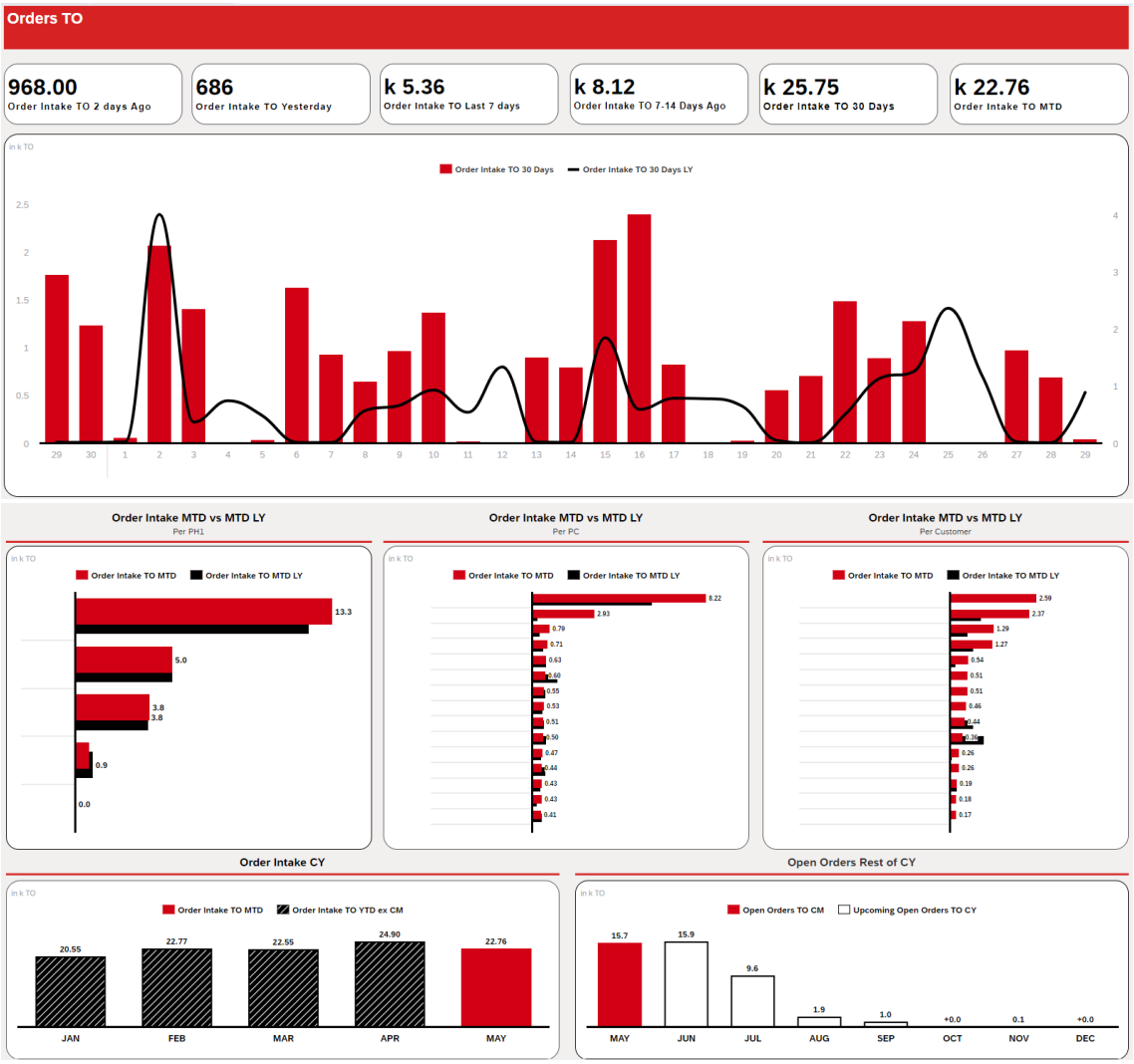
Appendices

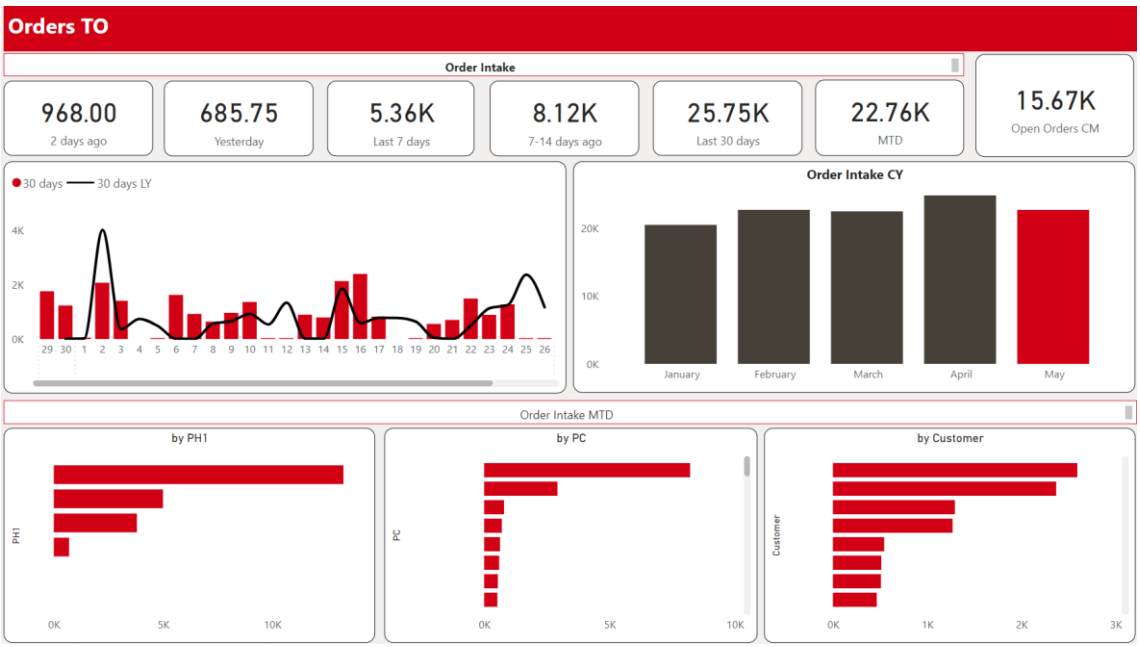
Appendix A – Visualization tool: tonnes pages

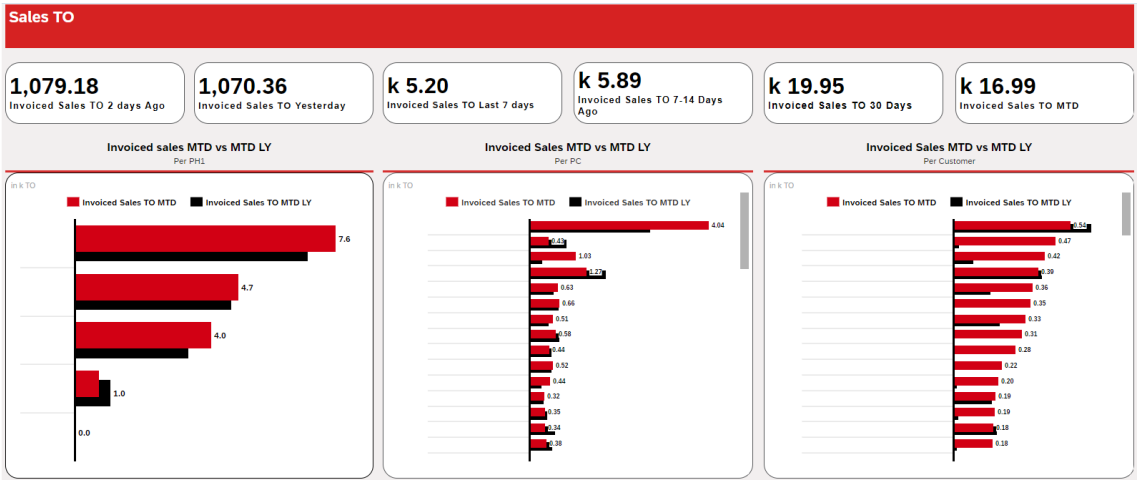
Screenshots of the pages corresponding to the metrics in tonnes are given below.

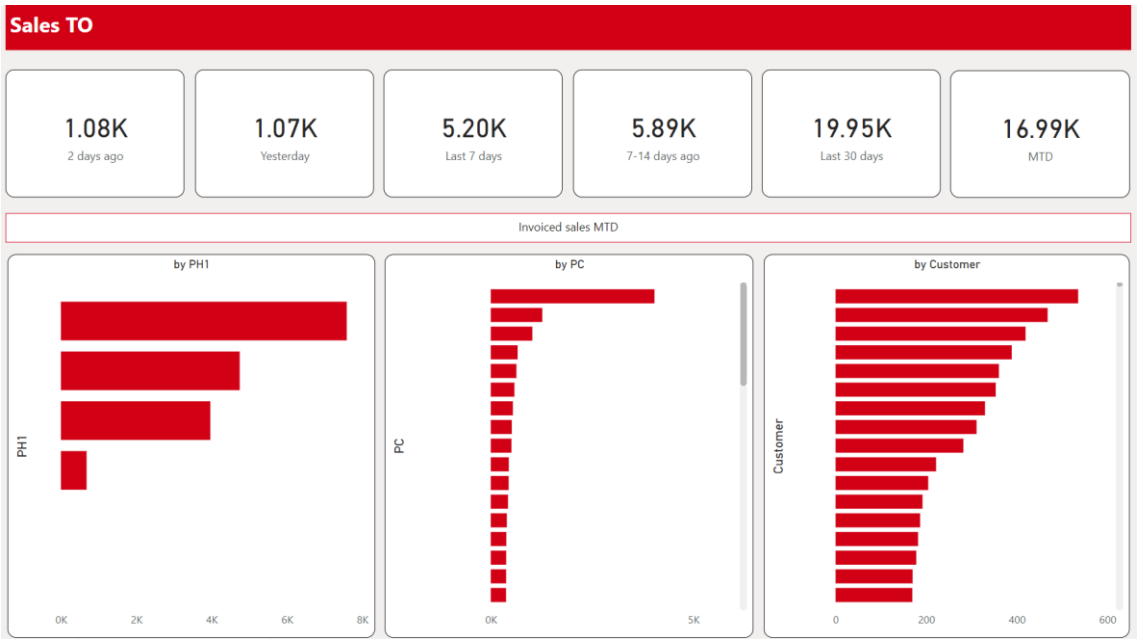





Orders TO
968.00
Order Intake TO 2 days Ago
686
Order Intake TO Yesterday
k 5.36
Order Intake TO Last 7 days
k 8.12
Order Intake TO 7-14 Days Ago
k 25.75
Order Intake TO 30 Days
k 22.76
Order Intake TO MTD
in k TO
Order Intake TO 30 Days
Order Intake TO 30 Days LY
Order Intake MTD vs MTD LY
Per PH1
Order Intake MTD vs MTD LY
Per PC
Order Intake MTD vs MTD LY
Per Customer
Order Intake TO MTD
Order Intake TO MTD LY
13.3
5.0
3.8
3.8
0.9
0.0
Order Intake CY
Order Intake TO YTD ex CM
20.55
22.77
22.55
24.90
22.76
JAN
FEB
MAR
APR
MAY
Open Orders Rest of CY
Open Orders TO CM
Upcoming Open Orders TO CY
15.7
15.9
9.6
1.9
1.0
+0.0
0.1
+0.0
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC


Orders TO
Order Intake
968.00
2 days ago
685.75
Yesterday
5.36K
Last 7 days
8.12K
7-14 days ago
25.75K
Last 30 days
22.76K
MTD
15.67K
Open Orders CM
30 days
30 days LY
Order Intake CY
January
February
March
April
May
Order Intake MTD
by PH1
PH1
by PC
PC
by Customer
Customer


Sales TO
1,079.18
Invoiced Sales TO 2 days Ago
1,070.36
Invoiced Sales TO Yesterday
k 5.20
Invoiced Sales TO Last 7 days
k 5.89
Invoiced Sales TO 7-14 Days Ago
k 19.95
Invoiced Sales TO 30 Days
k 16.99
Invoiced Sales TO MTD
Invoiced sales MTD vs MTD LY
Per PH1
Invoiced Sales MTD vs MTD LY
Per PC
Invoiced Sales MTD vs MTD LY
Per Customer
Invoiced Sales TO MTD
Invoiced Sales TO MTD LY


Sales TO
1.08K
2 days ago
1.07K
Yesterday
5.20K
Last 7 days
5.89K
7-14 days ago
19.95K
Last 30 days
16.99K
MTD
Invoiced sales MTD
by PH1
PH1
by PC
PC
by Customer
Customer

Appendix B – Sustainable development goals

The 2030 Agenda aims to turn the Sustainable Development Goals, commonly known as SDGs, into reality. Believing in the possibility of a better and fairer world, it is essential to align both governmental and enterprises strategies with the goals in the agenda by implementing measures that support their achievement.

In this thesis, it has been considered important to highlight certain goals that are related to the topic and scope of the project. This is done to demonstrate greater social responsibility in the work that has been carried out.

The following are the SDGs that can be associated with the project.

Goal 8: Decent work and economic growth

The full extension of this goal is: "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all". After creating both the tool selection guide and the dashboard, it is expected to create economic growth in the company driven by increased productivity and process facilitation.

Goal 9: Industry, Innovation and Infrastructure

The description of this objective is: "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation". By developing a new dashboard that allows upper management to improve their decision making, an innovative tool has been created that can make a breakthrough in the operation of the company.

Table 2. Degree to which the work relates to the Sustainable Development Goals

Sustainable Development Goals	**High**	**Medium**	**Low**	**Not applicable**
SDG 1. **No poverty**				X
SDG 2. **Zero hunger**				X
SDG 3. **Good health and well-being**				X
SDG 4. **Quality education**				X
SDG 5. **Gender equality**				X
SDG 6. **Clean water and sanitation**				X
SDG 7. **Affordable and clean energy**				X
SDG 8. **Decent work and economic growth**		X		
SDG 9. **Industry, innovation and infrastructure**		X		
SDG 10. **Reduced inequalities**				X
SDG 11. **Sustainable cities and communities**				X
SDG 12. **Responsible consumption and production**				X

SDG 13. **Climate action**				x
SDG 14. **Life below water**				x
SDG 15. **Life on land**				x
SDG 16. **Peace, justice and strong institutions**				x
SDG 17. **Partnerships for the goals**				x

Source: Own elaboration.