UNIVERSITY OF LJUBLJANA
SCHOOL OF ECONOMICS AND BUSINESS

MASTER'S THESIS

THE USE OF DATA ANALYTICS FOR PROCESS IMPROVEMENT: THE CASE OF AN INTERNATIONAL PHARMACEUTICAL COMPANY

Ljubljana, September 2025   NATAŠA JAZIĆ

AUTHORSHIP STATEMENT

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LIST OF ABBREVIATIONS

AI – Artificial Inteligence
API - Application Programming Interface
BI - Business Intelligence
CRM – Customer Relationship Management
ERP - Enterprise Resource Planning
IDT - Innovation Diffusion Theory
IT – Information Technology
JIT – Just in Time
KPI – Key Performance Indicators
MS - Microsoft
MTD - Month-to-Date
NLP - Natural Language Processing
P&G - Procter & Gamble
PBC - Perceived Behavioural Control
PEU - Perceived ease of use
PU - Perceived usefulness
R&D - Research & Development
SC - Supply chain
SCM – Supply chain management
SCOR - Supply Chain Operations Reference
SCT - Social Cognitive Theory
SKU - Stock Keeping Unit
SQC - Statistical Quality Control
SST - Stock Shortage Tracker
TAM - Technology Acceptance Model
TPB - Theory of Planned Behaviour
TPT - Throughput Time
TR - Technology Readiness
TRA - Theory of Reasoned Action
TRI - Technology Readiness Index
UTAUT - Unified Theory of Acceptance and Use of Technology
YTD - Year-to-Date

1   INTRODUCTION

Data comes in many forms, including censuses, statistics, research findings, figures, charts, interview transcriptions, diary entries, and more (Oyelude, 2017, p. 24). Oyelude (2017) explains that data is important for research because it has high information value, i.e. value-added information that is crucial for decision-making. Greco (2021, p. 5) builds on this idea by defining data as information collected for analysis and subsequent discussion, as he believes raw data is of no use. The same opinion is shared by Manoharan et al. (2023), who point out that data plays a crucial role in organisations and adds value to businesses; however, to unlock this value, it is essential to have proper analytics.

Data analytics is the process of collecting and analysing raw data to inform decisions based on the information gathered. Analytics techniques offer companies valuable insights that enable them to enhance their performance. They can enhance knowledge about customers, budgets, advertising campaigns, and more. Data analysts and scientists use data analysis techniques within their organisations to make informed decisions. Data analytics can help companies learn more about their users, personalise content, develop products and create content strategies (Manoharan et al., 2023, p. 65).

According to Malik et al. (2019), data science and data analytics have undergone fundamental changes in the 21st century. Easy access to computers has allowed companies and organisations to transform the way they work with larger and more complex data sets. Using data, insights that would have been virtually impossible to find 50 years ago can now be found with just a few lines of computer code (Malik et al., 2019). Data science, along with data analytics, has been used in various industries and fields (Greco, 2021, p. 7).

Numerous studies have been conducted to demonstrate the importance of data in Supply Chain Management (SCM). SCM is defined as a variety of tasks necessary to plan, manage and implement the flow of goods from the supplier to the end consumer in the most efficient way. SCM includes key components, procedures and tests (Kumar et al., 2024, p. 3). The same authors also point out that SCM encompasses the coordination of activities and processes related to the acquisition, production, storage, and distribution of goods and services. Huang (2011 p. 227) adds to the definition that SCM encompasses all information, financial and physical flows from the supplier's supplier to the customer's customer. The idea of SCM is to view the chain as an integrated system and to align decisions on how to operate the various components (companies, functions and activities) in such a way that the most desirable overall system performance can be achieved in the long term.

The SCOR (Supply Chain Operations Reference) is a reference model designed for managing supply chain processes. It enables businesses to examine, enhance, and convey practices related to SCM within their organisation, as well as with their partners and clients. Carmignani (2009, p. 399) states that SCM consists of all stages that are directly or indirectly

involved in fulfilling a customer request and that SCM involves managing the flows (products, information and money) between and among the stages in SCM to maximise overall profitability. This author has also defined four main processes in SCM: Customer Requirements and Demand Analysis, Information Management and Exchange, Inventory Management, and Asset and Transportation Management. He also claims that many authors consider the latter three processes as the most important factors that determine supply chain performance (Carmignani, 2009, p. 340).

Singh et al. (2016) define SCM in the pharmaceutical industry as a specific supply chain in which drugs are manufactured, transported and consumed. They add that SCM is a complex and challenging task due to changing trends in growing product diversity, short product life cycles, increasing outsourcing, continuous advances in information technology and globalisation of businesses.

Due to increasingly complex and dynamic business environments, Gruchman et al. (2023) argue that leveraging data analytics and introducing new technologies to enhance supply chain activities and processes is essential. In the pharmaceutical industry specifically, high-quality standards must be met, requiring transparency and visibility in SCM (Gruchman et al., 2023).

The combination of data and data analytics has significantly improved SCM business processes (Nguyen et al., 2021). The study by Auramo et al. (2005) highlights the importance of using IT in SCM processes. The improved efficiency enables the company's employees to focus more on important business activities. The use of e-business solutions enhances the quality of information, supports collaboration in planning, and improves the agility of the supply network (Auramo et al., 2005).

Digitalization in SCM is of increasing strategic importance for businesses as it has an impact on established paradigms, business models and industry boundaries (Herold et al., 2021). The findings of Gong (2023) suggest that the digitalization of SCM can lead to the development of new and valuable resources that can provide a sustained competitive advantage.

The motivation for this research stems from the need to enhance supply chain efficiency and responsiveness in the pharmaceutical industry, a sector characterised by high complexity and regulatory demands. The primary purpose of this research is to analyse the process of measuring Key Performance Indicators (KPI) in the SCM of a pharmaceutical company, using Qlik Sense as a data analytics tool. The study seeks to identify areas for process improvement and assess the organisation's readiness and strategic orientation toward digital transformation in supply chain practices. The goal of my master's thesis is to provide a method for simplifying the lengthy, overwhelming, and time-consuming manual work processes using data tools. The intended outcome of this research is to demonstrate how SCM in an international organisation can be optimised through the use of data tools to reduce

manual labour, save time, enhance data accuracy, and improve overall supply chain performance.

Therefore, the main research questions are:

1. How can companies improve their KPI measurement process using the available Qlik Sense tool?
2. How does the Analytics team perceive the usefulness of Qlik Sense in supporting supply chain management processes within a pharmaceutical company?

This master's thesis is structured into six main chapters. The first three provide a theoretical foundation by reviewing existing literature in the domains of data and data analytics, digitalization, SCM, and change management. These chapters draw on secondary sources to establish the broader context of the research.

The latter three chapters present the case study. This section begins with an introduction to the company, its operational processes, and the role of SCM within its organisational framework, based on primary data. To gather insights, I conducted interviews with three members of the Analytics team and examined internal documents, with particular attention to KPIs. The analysis focuses on the company's business practices and how data-driven approaches are applied within its supply chain operations.

Following the presentation of the proposed solution, the focus shifts to its adoption by potential users—specifically, employees within the analytics department at global, regional, and local levels. To assess user reception and gather insights, survey was conducted among the same group of employees, serving as a primary data source. The collected feedback was used to evaluate the effectiveness of the solution and to identify its potential benefits for the organisation. The thesis concludes with a discussion and final remarks, in which the research findings are interpreted, contextualised, and critically assessed.

Since the focus is on analysing the business case rather than any specific company, the organisation under study will remain anonymous for confidentiality reasons. It will be referred to as "selected company" throughout this thesis. The company is headquartered in Serbia and operates in several international markets. All data has been modified and does not represent the correct data of any particular company.

2 DATA AND DATA ANALYTICS

2.1 Data and overview of data types

Malik et al. (2019, p. 2) define data as recorded measurements of real-world phenomena. To illustrate this, they use a list of heights as an example. Height refers to the measured distance between a person's head and feet—an example of how data captures physical attributes. The

unit of observation is the entity described by the data; in this case, each person whose height is measured represents a unit of observation. A data point consists of one or more measurements that describe a single unit of observation, with each measurement known as a variable. A dataset is then formed by combining multiple data points (Malik et al., 2019, p. 3).

Demchenko et al. (2018) lay the groundwork for a broader conversation around treating data as an economic asset and creating a future open data market supported by a shared infrastructure. They build on past and ongoing debates to shape this concept. Today, businesses, governments, researchers, and individuals have access to far more data than was imaginable just a decade ago. In addition to traditional sources, such as corporate databases and applications, data now also comes from open platforms, social media, and innovative technologies—such as smartphones, smart meters, vehicles, and industrial machinery (Demchenko et al., 2018).

Oyelude (2017) emphasises the importance of properly organising data so that it can be presented in value-added formats and made more accessible to users. This is especially crucial given the complex nature of data creation, processing, organisation, sharing, and preservation. To navigate these tasks effectively and in line with accepted standards, data professionals must be skilled in using the right tools and research methodologies. Oyelude (2017) further suggests that well-trained data professionals should also take the role of educating users—a key step toward solving the problem of data overload and making data truly usable.

Cheng et al. (2023, p. 4) highlight the importance of data collection for managers, executives, and other key stakeholders in making informed decisions. They point out that raw historical data from internal sources—like databases, spreadsheets, data warehouses, customer relationship management (CRM) systems, and transaction records—can be leveraged to support decision-making at strategic, tactical, and operational levels. This data helps identify emerging trends and patterns, enabling organisations to make more timely and well-informed strategic choices.

According to Greco (2021, p. 6), there are two categories of data: quantitative and qualitative.

Qualitative data are defined by Wilson (2019) as information that is observed, categorised, and documented in a way that is not numerical. Focus groups, case studies, testimonials, interviews, and other comparable methods are frequently used to collect qualitative data. Quantitative data refers to any information that can be assigned a numerical value. Height, weight, clothing size, income level, traffic volumes, number of sales, and many other factors are examples (Malik et al., 2019).

Data can also be categorised into two main types: structured and unstructured.

Structured data is described as highly organised, typically stored in relational databases or spreadsheets, and easily searchable using traditional tools like SQL. It includes quantitative data such as dates, transaction amounts, and inventory levels. This type of data is ideal for reporting, querying, and dashboarding, making it central to business intelligence systems (Wang et al., 2018).

Unstructured data, by contrast, lacks a predefined format or schema. It includes qualitative content such as emails, images, videos, and social media posts. Analysing unstructured data requires advanced techniques, such as natural language processing (NLP) and machine learning, as it is more complex and context-rich. Despite its challenges, unstructured data holds valuable insights that structured data may miss (Wang, et al., 2018).

According to Oyelude (2017, p. 24), data can be presented in various formats, including figures, graphs, statistics, interviews, journal entries, and more. These forms of data are found in both standard and structured storage locations, including books, CDs, theses, dissertations, maps, and also in more formal repositories like government ministry archives, statistical offices, and libraries (Oyelude, 2017, p. 24).

Selmy (2024) explains that in computer science and programming, the term data type refers to a category or grouping of data values. Each data type is usually defined by the operations that can be performed on it, the range of possible values it can hold, and how the computer represents those values. Programming languages may use different data types or similar types with varying meanings and behaviours, depending on how they're designed.

2.2   Usefulness of data analytics

Data plays a significant role and adds value to companies; however, unlocking such value is crucial, and having a dedicated analytics platform is essential (Manoharan et al., 2023). They define data analytics as the "extensive and systematic use of data, statistical and quantitative analysis, exploratory and predictive analysis, and fact-based management to drive business decisions and actions".

Like many other scholars, Malik et al. (2019, p. 3) argue that raw data alone are not helpful for decision-making. They emphasise the importance of identifying patterns—what we call information. The transformation from data to information is known as data analysis. When data analysis is combined with predictive methods, it evolves into data analytics (Malik et al., 2019, p. 3). According to Manoharan et al. (2023, p. 65), data analytics excels at uncovering risks, spotting trends, and revealing new opportunities for businesses.

Wilson (2019, p. 11) describes data analytics as platforms and applications designed to support tracking, benchmarking, analysing, and reporting data. These tools often serve as the front-end interface for users, presenting data in a clear, intuitive, and accessible manner.

Analytics software also enables users to easily search, filter, and view summarised information, making data more usable and actionable.

Manoharan et al. (2023, p. 65) highlight that data analytics techniques provide businesses with greater accessibility to valuable insights, which can contribute to improved performance. Data scientists and analysts use these techniques to support decision-making across both business operations and research. Data analytics can inform product development, shape content strategies, and offer a deeper understanding of customer behaviour. The authors emphasise the importance of data analytics by noting that it helps companies enhance profitability and overall business performance. By drawing actionable insights from data, organisations can adjust their processes to make more informed and effective decisions.

The benefits of data analytics for companies are numerous, and Manoharan et al (2023) list some of them:

- Enhanced Decision-Making - companies can leverage insights gained from data analytics to make informed choices that lead to stronger business performance.
- Improved Customer Service - data analytics reveals customer preferences, concerns, and communication styles, helping businesses tailor their services to meet user needs more effectively.
- Successful Marketing - by analysing campaign performance, companies can understand what resonates with their audiences and refine marketing strategies to maximise results.
- Streamlined Operations - data analytics helps optimise business processes, reduce operational costs, and improve overall efficiency—ultimately boosting the bottom line.
- Risk Management - companies can use data analytics to identify potential risks early and implement preventive measures to avoid disruptions.
- Strengthened Security - analysing past data breaches through visualised patterns allows organisations to uncover vulnerabilities and take proactive steps toward better data protection.

Oyelude (2017, p. 24) emphasises that data analysts play a crucial role in bridging the gap between raw data and its users, helping make large volumes of information more accessible and usable.

One of the key responsibilities during data analytics is evaluating the source of the data being used. Analysts should clearly highlight the reliability of their data sources in reports and carefully consider the credibility of the sources before conducting any detailed analysis. To reduce bias in data origin, several steps can be taken: conducting thorough research to gather a wide range of relevant information; reviewing similar studies to anticipate potential challenges; and asking thoughtful, critical questions—a skill that develops over time through training and experience (Greco, 2021, p. 42).

2.3   Data analytics tools

Some of the widely known and used data analytic tools are (Greco, 2021, p. 43):

- Microsoft Excel
- R programming language
- Tableau
- Microsoft Power BI
- SAP and SAP Analytics Cloud
- Qlik Sense

Microsoft Excel is a spreadsheet program that provides fundamental data manipulation and visualisation capabilities (Tripathi et al., 2023). Excel is the go-to data analytics tool (Greco, 2021, p. 43). The primary use of Microsoft Excel in the workplace is for business analysis. Business analysis is essentially the use of collected data to support decision-making (SA Campus Online, n.d.).

MS Excel is a powerful way to organise information about people, whether they are employees, customers, supporters, or training attendees. Using Excel, personal data can be stored and retrieved efficiently, making it a valuable tool for personnel management (SA Campus Online, n.d.).

MS Excel is an essential tool for many small businesses in managing operations. An advantage of Excel is that it is relatively low-tech, allowing it to be used by many people without the risk of programming bugs. Performance monitoring and reporting is a specialised type of business analysis that can be done effectively using MS Excel. Office administrators use Excel to enter and store much of the data that is subsequently used for accounting and financial reporting, business analysis, and performance reporting (SA Campus Online, n.d.).

Excel has been shown to be useful for data organisation, data analysis, visualisation, data modelling, automation and collaboration (insightsoftware, n.d.).

Some of the benefits of using MS Excel are (insightsoftware, n.d.):

- Versatility: Excel can be used for a wide variety of tasks, from simple data entry to complex financial modelling,
- Accessibility: With an intuitive interface and extensive documentation, Excel is accessible to both beginners and advanced users,
- Integration: Excel integrates seamlessly with other Microsoft Office applications, making it easy to import and export data across platforms,
- Automation: Automate tasks with macros to save time and reduce manual errors,
- Data Analysis: Excel's powerful tools allow for in-depth analysis, helping make data-driven decisions,

- Customisation: Tailor Excel to meet your specific needs with customisable templates, formulas, and add-ins.

R programming language is a free, open-source programming language tailored for data visualisation and statistical analysis. R is a statistical tool that is becoming more prevalent in analysis.

R provides a wide variety of statistical and graphical techniques, and is highly extensible (R Project, n.d.).

The R language is most used for data analysis and statistical computing. It's also an effective tool for machine learning algorithms. The program can be used to create graphics, such as charts, and apply statistical techniques like data reduction, classification, and clustering. One advantage of this tool is that it is both free and open-source. The functionality of this tool extends to text mining, which is utilised when there is a need to track textual data, such as when surveys contain textual answers (Greco, 2021, p. 43).

 R environment includes (R Project, n.d.):

- an effective data handling and storage facility,
- a suite of operators for calculations on arrays, in particular matrices,
- an extensive, coherent, integrated collection of intermediate tools for data analysis,
- graphical facilities for data analysis and display either on-screen or on hardcopy, and
- a well-developed, simple and effective programming language that includes conditionals, loops, user-defined recursive functions and input and output facilities.

Tableau is a powerful platform for building interactive dashboards and visualising data (Tripathi et al., 2023). Designed to operationalise information effectively, it enables users to create visually appealing dashboards that update in real time or on a schedule. Renowned for its strong data visualisation capabilities, Tableau transforms raw data into engaging visuals—earning its reputation as one of the most popular tools in business intelligence. As Shiramshetty (2024) notes, Tableau enables users to create live dashboards and reports, facilitating organisations in making quicker, data-driven decisions.

The connectivity feature, which enables the software to access data from both the cloud and the local database, supports the real-time data transfer required for dynamic analysis. Tableau is ideal for working with large volumes of data and creating visualisations. Because it can process large amounts of data and offer attractive graphics and a user-friendly interface, Tableau is used in finance, healthcare, and retail businesses (Shiramshetty, 2024).

The problem arises when it must work with very vast data volumes in real-time. With high levels of system resources to perform at their optimum, they may not be very helpful to small businesses without sufficient computational power (Shiramshetty, 2024).

Microsoft Power BI is a business intelligence tool that focuses on data visualisation and exploration (Tripathi et al., 2023). Power BI, which interacts with the Microsoft ecosystem, is a powerful tool for data analytics and real-time reporting. It also enables data consolidation from various sources, including cloud storage, databases, and on-premise applications (Shiramshetty, 2024).

According to Khan et al. (2023), Power BI is a versatile tool that supports data cleaning and preparation by providing users with a comprehensive interface for refining datasets before analysis. It excels at data manipulation through features like column pivoting, which reorganises data structure, as well as data type transformation, anomaly detection and highlighting, ordering, grouping, and formatting for visualisation. Power BI's built-in tools enable users to convert raw data into clear and compelling visuals—making insights easier to understand and communicate. The platform is recognised for its engaging, eye-catching graphics, enabling users to explore data and create impactful visual reports that support faster, more informed decision-making (Khan et al., 2023).

Power BI's affordability and easy accessibility make it an appealing choice for both small businesses and large organisations, especially those already using Microsoft Office tools (Khan et al., 2023). One of its key strengths is the ability to deliver real-time updates and status reports, along with customisable reporting features that align with specific business needs. The platform simplifies data source integration by seamlessly connecting to tools such as Excel, cloud services, and various databases, enabling efficient dashboard updates. Additionally, Power BI supports advanced data modelling techniques, including data transformation, cleansing, and shaping, which help users refine and prepare data for deeper analysis and visualisation (Tripathi et al., 2023).

Although Power BI offers robust real-time analysis capabilities, its data presentation and customisation options are not as flexible or visually refined as those found in Tableau (Shiramshetty, 2024). Several limitations are noted: Power BI does not fully support automated processes such as auto-generated charts or streamlined data preparation. It also struggles to efficiently manage complex relationships among multiple tables in a data model, which can be an issue for large-scale datasets. Additionally, reports created in Power BI cannot be edited directly within its online service, which may restrict flexibility for remote collaboration or last-minute updates (Khan et al., 2023).

SAP and SAP Analytics Cloud are enterprise resource planning (ERP) software solutions often used in large companies, offering a wide range of functionality for various business activities. SAP Analytics Cloud is a cloud-based analytics platform that offers a variety of data visualisation and analytics capabilities. It delivers advanced analytics features, including predictive modelling, machine learning, and data discovery, as well as integration with various data sources (Tripathi et al., 2023).

Qlik Sense enables the creation of interactive dashboards and data visualisations. The platform allows businesses to consolidate and explore multiple data sources from a single location. Users can build, expand, and visualise analytics directly within existing sheets and dashboards using Qlik's flexible analytics tools (Tripathi et al., 2023).

Qlik Sense belongs to BI tool solutions which place a heavy emphasis on self-service and associative data modelling. Its span is the initiative associative engine, where the user can view the data from different perspectives and discover hidden connections, enabling them to make decisions based on the numbers in no time. Despite performing real-time data analysis, Qlik Sense offers advanced data visualisation capabilities and is suitable for business organisations interested in combining intensive data analytics with ease of use. To this effect, its tight coupling with cloud platforms and other enterprise systems is also a plus (Shiramshetty, 2024).

Khan et al. (2023) describe the multiple ways data can be loaded into Qlik Sense—from various sources, including connectors, local files on a computer, and manual entry. Users can import data from Excel, HTML, and predefined file formats, or create scripts to handle non-Excel sources. Qlik Sense also allows users to browse sample data stored locally.

Data cleaning and preparation are streamlined by Qlik's associative engine, which automatically identifies common fields (key fields) between tables when scripts are executed. The Table Viewer then displays the resulting data structure. With the Data Load Editor, users can manipulate and transform data using custom scripts and expressions. This process involves connecting data to the editor, adjusting expressions as needed, and then loading the data for visualisation. Qlik Sense's dynamic visualisation tools enable users to customise charts by adding dimensions and measures to explore data more effectively (Khan et al., 2023).

Qlik Sense stands out due to its unique features, particularly its associative engine. This engine helps users easily find and understand connections between different pieces of data while analysing, making it easier to discover valuable insights that might otherwise be missed. The tool enables fast and versatile analysis and querying of the data, and also allows one to view insights from as many angles as possible, even as the data is being updated. Qlik Sense supports databases that are both on-premises and cloud-based, making it perfect for enterprises due to its flexibility in scaling up. Its data processing features data connectors that allow for the display of current, real-time data in the dashboards. Qlik Sense can be tricky for people who aren't accustomed to its data linking approach. Its interface is also not as sleek or modern-looking as Tableau's, which might turn off some users, especially those who are not very tech-oriented (Shiramshetty, 2024).

Pros of Qlik Sense according to Khan et al. (2023) are:

- Faster in storing data of all sizes

- Has more scalability than all other tools
- Fine-tune memory processing
- Data load editor to perform pre-processing
- Insight advisor chat in Qlik is a natural language processing (NLP) based tool that allows users to create their own vocabulary and answer any kind of queries from all their data.
- Automatic chart building helps to save time
- QLIK is an AI-based tool and uses numerous API to make visualisation interactive and easier
- Storytelling allows users to add bookmarks and sheets to present their visualisation

Cons of Qlik Sense, according to Khan et al. (2023), are:

- Language specified - the user should know about the data load editor language
- Data modelling and merging are also language-specific – needed technical knowledge

Pharmaceutical Companies that are utilising Qlik Sense:

- Novartis - The Swiss multinational pharmaceutical company Novartis employs Qlik Sense across its organisation, with 30,000 employees accessing over 500 Qlik applications. This widespread use has led to substantial savings through optimised budgets and resource allocations. The platform supports various departments, including procurement, production, marketing, sales, finance, and management, by providing a unified and validated data source for decision-making (SupplyChainIT, n.d.).
- URSAPHARM, a medium-sized pharmaceutical manufacturer, implemented Qlik Sense to improve company-wide analytics. The platform facilitates data integration from various systems, enabling departments like production, materials management, and sales to make informed decisions. Automated reporting and planning are also streamlined through Qlik's capabilities. Due to success and a high level of acceptance, the team is planning further process optimisation projects with Qlik Sense. The focus will be on projects along the supply chain to optimise business processes in the best possible way (Muthweiler, n.d.).
- Ferring Pharmaceuticals, a global biopharmaceutical company, implemented Qlik to enhance its sales performance and marketing initiatives. By aggregating data from multiple sources into a single analytical interface, Ferring achieved an 80% reduction in the time required to create analytical reports. This implementation allowed employees to customise reports and identify data entry errors, thereby improving data quality and decision-making processes (BioSpace, 2016).

Figure 1: Gartner Magic Quadrant for BI and Analytics Platforms

Source: Gartner (2020).

Figure 1 represents the 2020 Gartner Magic Quadrant, which compares and positions tools in the analytics and business intelligence (BI) market. The Magic Quadrant is divided into four quadrants:

- Leaders: Companies in this quadrant demonstrate a high ability to execute and possess a comprehensive vision. They are considered strong performers in both dimensions.
- Challengers: Companies in this category have a high ability to execute but may have less comprehensive vision compared to leaders.
- Visionaries: These companies have a well-rounded vision but may lack the same level of execution as the leaders.
- Niche Players: Companies in this quadrant may be more focused on a particular niche or have a limited ability to execute and a less comprehensive vision.

Each dot represents a company's position, providing a comparative snapshot of the BI and analytics platform landscape at the given time. It is visible that Microsoft, Tableau and Qlik are positioned as leaders in the analytics market. SAP (together with other tools) is positioned as visionary.

3 SUPPLY CHAIN MANAGEMENT

3.1 Process management in supply chains

SCM is the systemic and strategic coordination of traditional business functions and their associated tactics—both within a company and across businesses in the supply chain—with the goal of enhancing long-term performance (Andrushko, 2023, p.5)

All authors agree that customer satisfaction is the most crucial aspect of the supply chain process. According to Herzer & Schreiber (2023, p. 4), the term "supply chain" refers to a collection of operations that provide value for the customer. According to Carmignani (2009, p. 399), a supply chain must include every step that is directly or indirectly involved in completing a customer request to maximize overall profitability.

By maximizing delivery and production schedules and ensuring that the right product is delivered at the right time to the right location, SCM helps businesses and consumers alike (Kaleli & Baygin, 2022, p.78). The authors explain that by eliminating the need for large, fixed assets like warehouses and delivery trucks, SCM helps reduce a company's operating costs and boosts its potential cash flow.

The SCOR model is a framework for managing supply chain processes. It enables organizations to analyze, improve, and communicate supply chain management practices both internally and with external partners and customers. The SCOR model is an initiative of the Supply Chain Council and categorizes the business tasks involved in meeting all aspects of customer demand. This includes planning, sourcing, manufacturing, delivering, and returning, as well as enabling functions. SCOR model provides users with a complete set of processes, metrics, and best practices all built around a consistent framework for communication among supply chain partners (Huang et al., 2004).

Companies should use SCM practices that increase effectiveness and efficiency, according to Herzer & Schreiber (2023, p. 4). Furthermore, SCM calls for partner cooperation and trust, as well as alignment, integration, and the exchange of best practices. SCM's primary goal is to create a win-win situation for all involved. When companies implement an efficient SCM system that aligns with their organizational structure, they can promptly address demands that arise at different phases of the production or service process. (Kaleli & Baygin, 2022, p. 82).

Huang (2011) distinguishes between two approaches to SCM: the bottom-up approach and the top-down approach. While the bottom-up approach looks at the specifics of each link in the supply chain and tries to find the best solution globally, the top-down approach manages the chain through high-level, centralized strategic planning and distributed task execution. In theory, a truly optimal solution can be obtained through the bottom-up approach.

However, the top-down strategy is more realistic and efficient because of the complexity of a supply chain and the dynamic environment.

Businesses can benefit greatly from using supply chains, but they also occasionally need to consider the various risks involved. The two primary categories Kaleli & Baygin (2022, p. 82) group them under:

- External Risks: These are defined as the risks beyond the control of the enterprise. Examples include the rise of raw material prices, natural disasters, economic crises, strikes, and terrorist attacks.
- Internal Risks: These are defined as the risks that are within the control of the business. Examples of these include equipment failures, supplier quality problems, distribution chain disruptions, changing customer demands, transportation errors, technological changes, and tax increases.

3.2 Importance of measurement of key performance indicators in supply chains

Companies are working to increase and optimise their productivity to stay competitive in the face of fierce global competition and rising stakeholder demands (Muchiri et al., 2009). To do that, they must gauge their level of development. Through measurement, companies can compare their present practices to those of the highest-achieving members of their industry (Anand & Grover, 2013, p. 136). Because of that, Muchiri et al. (2009, p. 5905) state that performance measurement is a fundamental instrument of management.

KPI data typically originates from transactional systems, ERP platforms, CRM tools, and operational databases. These systems capture raw data, including sales figures, production output, customer interactions, and financial transactions. Raw data is cleaned, normalised, and aggregated to ensure consistency across departments. This step often involves utilising data governance frameworks and conducting quality checks to prevent misleading KPI results. KPIs are computed using predefined formulas (e.g., Customer Retention Rate = (Customers at End – New Customers) ÷ Customers at Start) (Van Looy & Shafagatova, 2016). Advanced organisations integrate predictive analytics and machine learning to move beyond retrospective metrics toward forecasting performance trends. KPI results are visualised through dashboards, scorecards, and business intelligence tools for decision-making (Schrage & Kiron, 2018).

An organisation's ability to track progress against its strategy, identify areas for improvement, and act as a good benchmark against competitors or industry leaders makes performance measurement even more important in turbulent and competitive global markets. This enables managers to make informed decisions at the correct times (Shaw et al., 2010, p. 322).

According to Shaw et al. (2010, p. 323), the problem with performance measurement in every organisation was that there were too many metrics, which frequently did not match the organisation's strategy and caused confusion. The authors discuss a balanced scorecard of metrics that, because these measures include both financial and non-financial information, provide managers with a quick yet thorough view of their business through four key perspectives: financial, customer, internal business, and innovation and learning.

Supply chain performance improvement is an ongoing process that requires a rational performance measurement system and the creation of a tool for understanding KPI goals. KPIs provide a comprehensive view of the supply chain, aiding in the evaluation of execution performance (e.g., actual sales versus forecast plan) and the accuracy of the supply/demand plan (e.g., forecast accuracy) (Anand & Grover, 2013, p. 136). Ensuring that planned and executed activities yield the desired results is one of management's primary concerns, and this can be facilitated by effectively utilising defined KPIs (Muchiri et al., 2009). Performance measures facilitate the execution and implementation of improvement initiatives by acting as a crucial link between strategies and management action. Selecting the metrics that are best suited for the business is crucial for making wise decisions. These metrics must include current, accurate, and comprehensible information presented in an easy-to-understand manner (Muchiri et al., 2009).

Supply chain-related KPIs have not been as widely adopted as financial KPIs. Businesses often find that there are limited applicable guidelines for creating KPIs (Anand & Grover, 2013, p. 136). Shaw et al. (2010, p. 320) emphasise the value of performance measurement systems in SCM and note that more complex and balanced approaches to measuring supply chain performance have replaced more conventional, stand-alone performance measures. According to them, this shift has been fueled by the globalisation of the supply chain, growing complexity, and efforts by supply chain managers and others to gain more visibility into areas that are not directly under their control (Shaw et al., 2010, p. 320).

Financial measures, such as profit or return on capital, have historically dominated SCM performance measurements, as they reflect an organisation's past performance rather than guaranteeing future results (Shaw et al., 2010, p. 322). Anand & Grover (2013, p. 135) elaborate on this by stating that both financial and non-financial performance should be included in the dimensions of performance to create a clear picture of how the supply chain operates.

Anand & Grover (2013, p. 135) note that it has always been challenging to select the appropriate set of KPIs to measure supply chain performance. According to Shaw et al. (2010, p. 323), supply chains are complex structures, and as a result, practitioners have developed numerous metrics systems for managing them. The authors discuss another global scorecard that has been proposed within SCM as a suitable framework for developing a more operationally, tactically, and strategically differentiated set of supply chain measures.

According to Shaw et al. (2010, p. 324), selecting the most appropriate and successful supply chain performance measures remains the largest challenge for organisations, even with the implementation of the new scorecard. To make sense of the increasing number of supply chain metrics and ensure that these metrics accurately reflect the constantly changing supply chain and business environment, managers should regularly review and evaluate their supply chain performance metrics. The authors also list eight criteria—level of detail, economy, validity, robustness, usefulness, compatibility, and behavioural soundness—on which to evaluate the quality of metrics (Anand & Grover, 2013, p. 137).

3.3 Benefits of data analytics use in supply chain management

According to Huang (2011), significant advancements in information technology over recent decades have made effective SCM increasingly feasible. Auramo et al. (2005, p. 83) identify the primary goals of IT in SCM as enabling collaboration among partners, ensuring information availability and visibility, and providing a single point of access for data. Notably, information sharing plays a critical role in enhancing collaboration and coordination across the supply chain. IT is seen as a key enabler of numerous opportunities—both broadly and specifically within the domain of SCM (Auramo et al., 2005, p. 84).

Gulledge and Chavusholu (2008, p. 750) emphasise that data is essential for effective decision-making and organisational management. In operations and SCM, data has long played a central role—particularly in areas such as production and logistics—through the use of statistics, optimisation techniques, and various supply chain analytics tools (Nguyen et al., 2021, p. 5407). Numerous empirical studies have demonstrated a positive correlation between the use of data-based tools and SCM efficacy across various nations and industries, as noted by Nguyen et al. (2021, p. 5408). Building on that, Hallikas et al. (2021, p. 629) state that firms need to be able to efficiently use and transform available data into information that is helpful for decision-making and coordination in purchasing and SCM if they want to strengthen their competitive position.

SCM is one of the areas where data has demonstrated remarkable value-added potential, according to Meriton et al. (2021). They argue that the dynamic and complex nature of SCM makes it especially suitable for data-driven solutions. The integration of data and related technologies has transformed SCM—from a predominantly clerical function into a highly connected, IT-enabled system that supports strategic decision-making and coordination.

SCM aims to optimise the flow of goods and materials by facilitating the exchange and analysis of data across internal and external business transactions. In response to market volatility and environmental changes, digitalising real-time information sharing between supply chain systems has become a central focus of SCM (Auramo et al., 2005, p. 84). As Sahay and Ranjan (2008, p. 28) note, every organisation strives to achieve "right access to information quickly," underscoring the value of timely and accurate data in decision-making and coordination.

Meriton et al. (2021) cite Toyota as an early pioneer of data-driven SCM. In the 1960s, the company implemented Jidoka, Just-in-Time (JIT), and Statistical Quality Control (SQC), which together formed the foundation of the Kanban production control method. As Toyota refined its JIT system, it began using data and insights from the Kanban methodology to monitor and manage the operations of its component suppliers more effectively.

Meriton et al. also highlight a later example of data-enhanced supply chain value: the mid-1980s partnership between Wal-Mart and Procter & Gamble (P&G). In this collaboration, Wal-Mart granted P&G access to its inventory data and stock-keeping unit (SKU) pricing information. This data-sharing arrangement enabled both companies to optimise inventory flows and quickly address discrepancies. In modern contexts, Amazon and Alibaba stand out as leading examples of business models built almost entirely around data-driven supply chain strategies (Meriton et al., 2021).

Frameworks and models for data-driven supply chain development have been widely discussed in SCM literature. The volume of data generated through SCM processes is expanding exponentially, increasing the importance of big data analysis (Nguyen et al., 2021, p. 5407). As Hallikas et al. (2021, p. 630) point out, developing methods to leverage data analytics in supply chain coordination is a crucial area of research, given the growing need to process vast and diverse datasets related to organisational operations.

An emerging challenge for businesses lies in the deepening interdependence between markets, supply chains, and enterprises. Sahay and Ranjan (2008) describe a comprehensive process for achieving business insight—beginning with the integration of data from multiple internal and external sources, followed by the application of analytical tools to interpret the data, and culminating in informed decision-making and strategic action.

3.4   Supply chain management in pharmaceutical industry

Ensuring a reliable supply of medications at a low cost, while minimising delays, shortages, and errors, is a key objective of the pharmaceutical supply chain (Mehralian et al., 2013, p. 75). Mehralian et al. further emphasise the pharmaceutical sector's vital contribution to the broader medical and healthcare continuum. Wong et al. (2023, p. 2) emphasise the importance of an optimally functioning pharmaceutical supply chain, highlighting that effective medication distribution relies on five key performance dimensions: price, dependability, flexibility, quality, and delivery.

The pharmaceutical industry encompasses a complex system of procedures, institutions, and activities dedicated to the development, design, and production of effective medicinal products. Its supply chain is particularly distinctive, encompassing not only the manufacturing and transportation of drugs but also their ultimate consumption by patients (Mehralian et al., 2013, p. 75). This highly regulated sector relies extensively on research. The pharmaceutical industry functions through a complex network of organisations,

processes, and innovations aimed at advancing pharmaceutical discovery and development (Gollu, 2017, p. 61). According to Mehralian et al. (2013, p. 76), this structure drives scientific and technological progress within the pharmaceutical sector, empowering manufacturers to develop profitable new treatments for conditions that were previously incurable or resistant to conventional therapy.

According to Wong et al. (2023, p. 1), while the pharmaceutical industry is not the only sector with life-saving potential, it stands out among supply chains due to its highly complex structure. This complexity arises from the critical need to supply pharmaceutical products accurately and efficiently, thereby meeting patients' medical needs. Furthermore, the industry is evolving toward personalised and patient-specific treatment approaches, which adds another layer of complexity.

One of the defining features of the pharmaceutical supply chain is its fragmentation and the involvement of a wide array of stakeholders. Singh et al. (2016, p. 235) highlight the complexity of the supply chain by identifying the numerous actors involved, including customers, information service providers, wholesalers, distributors, manufacturers, and regulatory authorities. Wong et al. (2023, p. 1) also note several factors contributing to supply challenges, such as the shortage of supplies, and identifying the underlying reasons of medicine shortages requires a thorough investigation. In the pharmaceutical industry, shortages of supplies are a serious issue with far-reaching effects. It influences not just the health outcomes of the individual but also the larger healthcare system. These shortages are caused by numerous factors, including complex global supply chain dynamics, manufacturing difficulties, and regulatory obstacles (Wong et al., 2023, p. 2). As Singh et al. (2016, p. 235) note, various challenges have contributed to the lack of comprehensive research on the pharmaceutical industry.

According to Reddy et al. (2017, p. 63), the pharmaceutical industry must strategically balance anticipated future demand with available production capacity during the design phase of the supply chain. This imperative arises from substantial uncertainty stemming from competitor activity and the outcomes of clinical trials. As regulatory pressures intensify and profit margins shrink, effective capacity utilisation and well-informed infrastructure investments are becoming increasingly vital.

4 DIGITALIZATION IN THE COMPANY AND ITS ADAPTATION TO CHANGES

4.1 Digitalization

Digitalization refers to the adoption of a broad array of technologies and processes that not only enhance operational efficiency, speed, and quality but also pave the way for entirely

new business activities through the intelligent use of data, information technology, and automation (Hallikas et al., 2020, p. 631).

As a result of its profound impact on the way businesses manage key resources and develop strategic plans, academic interest in digitalization continues to grow. Its transformative role in how organisations approach value creation, delivery, and capture has positioned digitalization as a central driving force behind the emergence of new business models and ventures (Massa et al., 2023). Kuusisto (2017, p. 342) defines digitalization as the deployment of digital tools and technologies to improve organisational performance, while also acknowledging its broader societal impact. This encompasses automated systems, data storage solutions, and digital communication technologies that are now integral to modern enterprises.

According to Matalamaki & Joensuu-Salo (2021, p. 384), the adoption of new digital technologies should be viewed as a strategic investment. Organisations implement digitalization not only to improve their operational efficiency but also to respond proactively to evolving customer needs and support customer-facing activities. One of the key advantages of digital technology lies in its ability to create connections among diverse stakeholders, both within the organisation and across external networks (Massa et al., 2023).

Matalamaki & Joensuu-Salo (2021, p. 380) argue that although companies may present themselves as technologically sophisticated based on their internal perceptions, the actual extent of their digitalization may differ significantly. Digital technologies challenge conventional notions of managerial and entrepreneurial decision-making, ushering in a more dynamic and unpredictable business environment.

Digitalization exerts a far-reaching influence across multiple dimensions of business strategy and operational practices (Matalamaki & Joensuu-Salo, 2021, p. 380). Its transformative effects create new pathways for corporate expansion and innovative growth strategies. However, as the authors emphasise, companies must confront the challenges that accompany digitalization to enhance their competitiveness and achieve sustainable advantages over industry rivals. Furthermore, digital technologies serve as essential precursors and enablers in the internationalisation process, making them indispensable tools for globally oriented enterprises (Massa et al., 2023).

The term "digitalization" in the context of supply chains refers to the implementation of systems and procedures that enable businesses to oversee the operations and processes of their supply chains (Hallikas et al., 2020, p. 631). According to Gupta et al. (2020, p. 1915), information technology and digitisation are necessary for effective control of product and information flow in today's complex supply chain, which also spans a widely dispersed geographic area.

From a business standpoint, digitalization offers solutions that can automate tasks requiring a significant amount of human resources, transform data into meaningful information, or reshape relationships within supply chains (Hallikas et al., 2020, p. 631).

Only when stakeholders develop a shared understanding that digitalization could present significant opportunities for their companies will the supply chain industry adopt digitalization (Herold, 2021, p. 1919).

According to Herold et al. (2021, p. 1931), digitalization is becoming increasingly strategic in the supply chain. Big data collection and analysis capabilities, enhanced information visibility and connectivity, and a physical network with quick and dependable delivery options will all have a big impact on supply chain networks and logistics productivity.

Through the creation and storage of data related to consumers, suppliers, and market dynamics, businesses can significantly enhance their performance by leveraging IT and digitalization within SCM. According to Gupta et al. (2020), digitalization not only improves operational efficiency but also strengthens geographically dispersed supply chain connections and enables more effective customer engagement. Hallikas et al. (2020, p. 631) expand on this by highlighting that a core objective of digitalization is to foster insight into changes within an organisation's environment—including shifts in markets, customer behaviour, and competitive pressures. To transform raw data into actionable intelligence, firms must possess the capabilities to identify, access, and collect relevant data; integrate and refine that data; and finally, apply robust data analytics to support informed decision-making (Hallikas et al., 2020, p. 631).

Supply chain's agility can be significantly enhanced through the strategic application of digitalization tools. The transportation management sector demonstrates the most extensive use of these tools within SCM. As Gupta et al. (2020, p. 1916) suggest, digitalization fosters new opportunities when suppliers, customers, and business partners engage in collaborative value co-creation. Hallikas et al. (2020, p. 631) emphasise that effective decision-making relies on descriptive, predictive, and prescriptive analyses—methods that deepen understanding of environmental patterns and trends. To fully capitalise on these insights, organisations must not only collect and access relevant data but also refine and interpret it using robust analytical capabilities.

4.2 Change management

Change management refers to a deliberate effort aimed at repositioning an organisation from its current state to a desired future state in response to emerging challenges and opportunities in the business environment (Hurn, 2012, p. 42). As Payne et al. (2022, p. 430) outline, change can be categorised into three distinct types: transformational, transitional, and developmental. These forms of change are often exemplified through initiatives that alter

organisational systems, structures, relationships, or procedures—all undertaken to ensure long-term survival and competitiveness (Payne et al., 2022, p. 430).

Adopting organisational change requires voluntary commitment, as it directly influences individuals' attitudes and beliefs (Payne et al., 2022, p. 430). Rather than being a linear or isolated event, change is a continuous, open-ended, and cumulative process involving the constant realignment of the organisation to an evolving external environment. For businesses to thrive in today's volatile landscape, the ability to implement effective changes is essential. As global competition intensifies and technological advancements accelerate, the demand for organisational agility grows (Payne et al., 2022, p. 429). Hurn (2012, p. 42) echoes this view, arguing that globalisation and economic uncertainty will remain persistent drivers of change. He highlights that competitive pressures, lower labour costs abroad, and the struggle to secure finite resources are among the key forces accelerating global integration and transformation.

Hurn (2012, p. 42) emphasises that the introduction of new technological advancements is itself a key driver of organisational change. He argues that such innovations can lead to more flexible working practices or a reduction in workforce participation due to automation. According to Payne et al. (2022, p. 432), innovation is essential for achieving effective business performance in response to evolving task demands and institutional pressures. They further assert that organisations must first prioritise internalising core values, foster employee adaptability, and cultivate change-oriented leadership before they can truly prepare for transformation (Payne et al., 2022, p. 433). Hurn (2012, p. 42) adds that to overcome resistance to change, businesses must ensure the presence of strong leadership capabilities, cross-level commitment, and adequate human and financial resources to support implementation efforts.

Resistance to change has long been recognised as a pivotal factor in the success or failure of organisational transformation (Waddell & Sohal, 1998, p. 543). Citing Block's (1989) definition, resistance is understood as an expression of reservation that typically emerges in response to change. Hurn (2012) stresses that resistance should be addressed on both individual and organisational levels. Human beings, inherently creatures of habit, often struggle to adapt to shifts in their routines, workplace policies, and conditions—particularly when it involves redistribution of authority or responsibilities. Employees may fear being overlooked or losing autonomy, which can lead to frustration when their freedom to pursue personal interests is curtailed. Additionally, the perceived security of established practices fosters a fear of the unknown, as the status quo has historically provided a sense of stability and predictability (Hurn, 2012, p. 42).

According to Hurn (2012, p. 43), a second—and potentially more influential—form of resistance to change arises at the organisational level, where it can embed itself within an institution's corporate culture. This form of resistance is potent because it reflects a persistent aversion to change across the organisation. In the context of multinational

corporations, Hurn notes that corporate culture comprises multiple interconnected elements, including the company's overarching goals, managerial approaches, ethical frameworks, and the national characteristics of its international leadership (Hurn, 2012, p. 43). These aspects collectively shape organisational behaviour, potentially reinforcing resistance when change challenges deeply held norms or disrupts established systems.

To elevate resistance to organisational change, Payne et al. (2022, p. 433) suggest maintaining continuity within management teams throughout the transition process. They note that when individuals are asked to change by someone they trust and know well, the level of resistance is often considerably reduced. Managing the stress that stems from real or perceived change is a critical concern for leadership, making transparency about the rationale for change essential (Hurn, 2012, p. 43). Open communication helps dispel uncertainty and fosters trust. In addition, Hurn (2012, p. 42) underscores the importance of thorough employee consultation across all levels of the organisation. Engaging staff meaningfully in dialogue not only reduces opposition but also cultivates a sense of shared ownership and acceptance of the transformation initiative.

Payne et al. (2022, p. 433) identify two distinct mental states through which individuals respond to change, equally complex to navigate. The rational dimension encompasses the logistical and procedural challenges associated with implementing change, while the irrational dimension reflects the emotional, psychological, and deeply human reactions that often disrupt progress. The irrational side poses the greater challenge, as it involves overcoming entrenched behaviours, organisational silos, and anxieties rooted in uncertainty. As Payne et al. (2022, p. 433) emphasise, leaders must first understand the cultural landscape of their organisation before effectively guiding individuals through change—mere mandates are insufficient. To counter resistance, two essential processes must be undertaken: leaders must learn to soothe uncertainty and cultivate the qualities of a change champion (Payne et al., 2022, p. 434).

Lewin created a three-stage model of behaviour modification in 1951, which is stated by Hurn (2012, p. 44) to help overcome resistance to change:

- Unfreezing – communicating the need for change and the resulting advantages.
- Movement towards the desired goal – nurturing the desired change of attitude through consultation with the support of key change agents.
- Refreezing – reinforcing and sustaining the new change through supporting procedures and policies.

Hurn (2012, p. 44) underscores the pivotal role of management in driving successful organisational change. Once broad support and consensus are achieved, it is the responsibility of managers to carry out the agreed-upon changes. To that end, establishing and maintaining an effective management team, comprised of leaders from all key functional areas, is essential. Hurn argues that managers should be seen as champions of originality and

innovation, capable of inspiring a widely shared vision for the future. To sustain momentum throughout the transition, organisations should consistently communicate progress, celebrating the completion of each milestone to keep stakeholders engaged and motivated.

4.3   Adopting new technology

When it comes to adopting new technologies—particularly digitalization—user reactions can vary widely. Over time, researchers have developed several theories to explain and predict how individuals accept and engage with technology.

Theory of Reasoned Action (TRA) was developed by Ajzen and Fisbbein in the field of social psychology to predict human behaviour. Based on this theory, attitude (A) and subjective norms (SN) are the two predictors of behavioural intention (BI), and intention is most likely to lead to performing a behaviour (BI = A + SN) (Hosseini, 2022).

Theory of Planned Behaviour (TPB) complemented TRA by adding the construct of perceived behavioural control (PBC) as another predictor of behavioural intention. Based on TPB, in some situations, even strong intentions do not lead to actual behaviour. By adding perceived behavioural control, realistic limitations, as well as self-efficacy are considered. Ajzen in 1991 defined subjective norms as individual's perceptions of other people's opinions of the behaviour, and perceived behavioural control refers to people's perception of the ease or difficulty of performing the behaviour of interest (Hosseini, 2022).

Technology Readiness (TR) is a theory of an individual's tendency to adopt and use new technologies. It is measured using the Technology Readiness Index (TRI), which consists of 36 items broadly categorised into four constructs: optimism, innovativeness, discomfort, and insecurity. In TRI, optimism refers to an individual's positive view toward a technology that shapes their perceived control, flexibility, and efficiency, while discomfort identifies a user's lack of control over the technology. Insecurity shows a user's inability to rely on technology (Hosseini, 2022).

Social Cognitive Theory (SCT) originated in the field of psychology. Researchers used this theory to understand individuals' cognitive, affective, and usage reactions to technologies. In a longitudinal study, perceived consequences of using computers were divided into two dimensions: performance-related and personal outcomes. Their findings show that computer self-efficacy and outcome expectations significantly impacted individuals' affective and behavioural reactions to information technology. Moreover, they found that computer self-efficacy is a continuing predictive factor of technology use and adoption over a long period of time (Hosseini, 2022).

The Technology Acceptance Model (TAM) was developed by Fred Davis from MIT, based on the theory of reasoned action (TRA). The theory was developed to study the use of IT systems in organisations where usage was voluntary – he aimed to understand how to

encourage professionals to adopt personal computing systems in the workplace (Hosseini, 2022).

Similar to TRA, TAM also suggests that user beliefs serve as mediators between external variables and the intention to use.

The two primary factors that Davis identified are:

- Perceived usefulness: The belief that using the new technology would enhance performance on a job or task.
- Perceived ease of use: The extent to which using the new technology would be free from effort.

A consistent finding across thousands of replications and applications of the model since then is that although perceived ease of use is a meaningful influence, perceived usefulness plays a more important role (Hosseini, 2022).

In 2000, Venkatesh and Davis developed TAM2. This extended model was tested in both voluntary and mandatory technology use settings, accounting for social influence (subjective norms, voluntariness, and image), cognitive instrumental processes (job relevance, output quality, and result demonstrability), and experience, which explained 60 per cent of user adoption (Hosseini, 2022).

In 2008, Venkatesh and Bala developed TAM3. TAM3 was designed to further elucidate the determinants of PEU (Perceived Ease of Use) and PU (Perceived Usefulness). They found that subjective norms, image, job relevance, output quality, and result demonstrability influence PU. PEU is influenced by anchor variables (computer self-efficacy, perceptions of external control, computer anxiety, computer playfulness) and adjustment variables (perceived enjoyment and objective usability), while experience and voluntariness act as modifiers of behavioural intention (Hosseini, 2022).

Innovation Diffusion Theory (IDT) focuses on the characteristics of a system or an innovation. This theory introduces the elements of communication, time, and social systems. Authors have highlighted the importance of communication, or the process by which innovations can be transmitted to or within a social system, such as through mass media and interpersonal channels, in determining the adoption rate (Hosseini, 2022).

The Unified Theory of Acceptance and Use of Technology (UTAUT) is one of the most widely used frameworks for understanding technology adoption today. According to its theoretical model, actual technology use is driven by behavioural intention. This intention is influenced by four key constructions (Venkatesh et al., 2003):

- Performance expectancy - the degree to which an individual believes that using the system will help him or her to attain gains in job performance

- Effort expectancy - the degree of ease associated with the use of the system
- Social influence - the degree to which an individual perceives that important others believe he or she should use the new system
- Facilitating conditions - the degree to which an individual believes that organisation and technical infrastructure exist to support the use of the system

The impact of these predictors is moderated by factors such as age, gender, experience, and voluntariness of use (Venkatesh et al., 2003).

- Age moderates the impact of all four key constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions.
- Gender affects the relationship between effort expectancy, performance expectancy, and social influence.
- Experience influences the strength of the relationships involving effort expectancy, social influence, and facilitating conditions.
- Voluntariness of use has a moderating effect solely on the relationship between social influence and behavioural intention.

4.4   Top management support as a part of change adoption

Successfully implementing organisational change remains a critical challenge for leaders across all sectors (Holten et al., 2019, p. 393). Hurn (2012, p. 42) argues that achieving meaningful transformation depends on the availability of essential leadership competencies, strong commitment throughout all organisational levels, and sufficient financial and human resources. Without these foundational elements, change initiatives are likely to encounter resistance, jeopardising their effectiveness and long-term impact.

Payne et al. (2022, p. 433) suggest that one way to overcome resistance to change is by maintaining the stability of management teams throughout the transition process. Their findings emphasise the importance of familiarity and trust. When individuals are asked to embrace change by someone they know and trust, they are more likely to respond positively, thereby reducing opposition and fostering a smoother transformation.

Hurn (2012, p. 44) emphasises that effective change management requires proactive and inclusive dialogue with key stakeholders, including employees, customers, suppliers, trade unions, and financial backers. He argues that cultivating involvement across all organisational levels is crucial for navigating transitions successfully. In contexts where resistance is anticipated, such participatory management styles are strongly recommended. Supporting this view, Payne et al. (2022, p. 433) caution against delegating authority without trust and collaboration, noting that upper management's dissatisfaction with lower-level execution can undermine the very change they initiated.

Payne et al. (2022, p. 433) stress the importance of allowing newly appointed managers sufficient time to adapt to the organisation's culture and assimilate its values. This acclimatisation period not only helps the newcomer develop a deeper understanding of internal norms but also eases their acceptance of impending changes. Hurn (2012, p. 42) reinforces the value of widespread employee consultation, urging leaders to engage staff at all levels to foster buy-in and reduce opposition. Echoing this human-centred approach, Waddell and Sohal (1998) argue that resistance to change often stems not from the change itself, but from fear of the unknown and concerns about its potential impact. This underscores the necessity of empathetic and communicative leadership in navigating organisational transformation.

Mitigating the stress triggered by real or perceived organisational change should be a central concern for management. Transparency in communicating the rationale behind change is essential; without it, uncertainty can give rise to damaging rumours and fear of the future. To counter this, managers should implement a comprehensive communication strategy—beginning with general consultations and briefings, followed by individualised interviews and, where necessary, counselling (Hurn, 2012, p. 42). Holten et al. (2019, p. 403) emphasise that the adverse emotional reactions often associated with change—such as anxiety, exhaustion, and stress—can be alleviated when employees trust their leaders' competence and intentions. Positive outcomes are more likely when staff feel informed, involved, supported, and respected throughout the process.

Hurn (2012, p. 44) highlights the importance of decisively moving forward with change once broad organisational support has been secured. This momentum is vital for ensuring that the agreed-upon changes are successfully embedded. Holten et al. (2019, p. 403) further emphasise that positive change experiences are more likely when employees feel consistently informed, involved, and supported throughout the transition. Trust in leadership competencies and clarity of purpose significantly improve satisfaction with the change process. Reinforcing this, Waddell and Sohal (1998, p. 547) assert that ongoing communication and consultation between management and employees is one of the most crucial success factors in implementing organisational change effectively.

To successfully implement organisational change, it is essential to build and sustain an effective management team composed of leaders from all key functional areas. Change managers must harness the diverse problem-solving capabilities of team members, drawing on wide-ranging expertise. They should be skilled negotiators with adaptability and a long-term perspective, capable of guiding initiatives with resilience and vision. Central to this effort is the continuous communication of the change strategy, particularly in relation to recruitment, training, professional development, and funding. To motivate others, change leaders must embody full commitment and serve as role models, demonstrating courage and decisiveness in uncertain conditions. Hurn (2012, p. 44) emphasises that these managers should be seen as champions of originality and innovation, cultivating a shared vision for the organisation's future.

Granting appropriate authority to individuals directly involved in the change process is critical for driving effective transformation. This requires ongoing dedication from top management, including steadfast support and the provision of essential resources to empower change agents (Hurn, 2012, p. 44). Without such backing, even well-conceived initiatives risk faltering due to a lack of direction, influence, or operational capacity.

Many authors have published case studies on various companies to bolster the claim that top management plays a crucial role in the change management process. Using a case study as an example, authors McCormack and Trkman (2014) detailed top management support during a company change. In the case study, the company sought to increase production, which meant that 10,000 remote workers would need to relocate from North America to other regions of the world. After a year, the manual procedures used to arrange the temporary workforce's housing and transportation were struggling to cope with the volume of assignments. The insufficient technological advancement in information processing capabilities to meet the evolving needs of the organisation led to a notable surge in expenses.

The concept and implementation of a web-based, self-service, centralised data repository was motivated by the realisation that manual processes were creating issues. The foundational system was developed in under ten weeks. Participants generally agreed that the system was simple to use, that information was instantly and widely available throughout the organisation, and—above all—that the system generated trustworthy results. The process team members were under pressure to utilise the developed business intelligence system, as senior directors and project management directors requested the use of business intelligence views. Additionally, it provided incentives for using business intelligence, allowing the senior director to acknowledge them. The notable savings were a result of the noteworthy performance outcomes.

The scenario shifted, with a large project management turnover following the departure of the senior director, a significant shift in behavioural incentives, and a gradual decline in analytics behaviour to just some transactional support. Seventy to eighty per cent of the staff who used business intelligence at work left in three years because the new leadership was generally unaware of the system's capabilities.

The new leadership brought about changes to the job requirements. Because it was not expected of them, workers' job competencies deteriorated when they used the business intelligence reports and analyses. After three years, the new management shut down most self-service requests because they believed that even the contractor employees' current processing capabilities were excessive. Instead, the process was returned to a standard Excel by email method, which included faxes and phone calls to a central data entry group. Restoring the old methods of labour also brought back the old expenses. The authors highlight that, because the new management did not even review the performance, they were unaware of the decline in performance.

This case study demonstrates clearly how powerful top management's influence is in both enacting change and upholding the current situation within the organisation. In this instance, the requested modification was implemented for the duration specified by management.

Oever and Martin (2015) present another instructive case study that reinforces the pivotal role of top management in organisational change. Their research focuses on a company undergoing a business model transformation, emphasising that managerial support is not merely beneficial but essential. They argue that the success of such initiatives hinges on securing top management's endorsement; without it, efforts to implement change are likely to falter. The authors conclude that upper management's commitment is a decisive factor in both initiating and sustaining business model innovation, further underscoring the strategic importance of leadership in change management.

5 METHODOLOGY AND COMPANY OVERVIEW

5.1 Methodology

To address the main research questions, a case study approach was selected. A case study is an empirical inquiry that investigates a contemporary phenomenon (the 'case') within its real-life context (Yin, 2014). This method offers a valuable understanding through the analysis of observed empirical evidence.

I had the opportunity to gain insight into the processes within the analytics team, which plays a key role in delivering business performance insights to both top and middle management. Among various responsibilities, the most crucial task was KPI measurement, as it represented the primary means of assessing the company's current state and progress.

To monitor KPIs, the team utilised Qlik Sense applications developed specifically for that purpose. Each application was designed to track a single KPI. For example, the Out of Stock Rate KPI is measured using the SAP system. Relevant data is extracted and transferred to a Microsoft Excel file via the SAP BI connector. Within Excel, data is cleaned, sorted, and prepared for publishing and usage. The refined data is then uploaded to the corresponding Qlik Sense application, which is subsequently ready for use.

All existing applications followed a similar workflow. When data modifications were necessary, they could be made directly within Qlik Sense, eliminating the need to repeat the entire preparation process.

Following the KPI measurement process, the results were typically presented in reports designed to help management understand the current situation and make informed decisions. I had the chance to familiarise myself with how various types of reports—differing in importance and length—were handled. Additionally, I gained a deeper understanding of the tools used to prepare these reports. In most cases, simple Microsoft Excel spreadsheets were

used, while in others, more advanced tools like Qlik Sense were applied—particularly when a report focused on a single KPI.

As previously mentioned, each Qlik Sense application was designed to track one specific KPI. Therefore, when a report required data from multiple KPIs, it was often necessary to export information from several applications and merge it into a Microsoft Excel file. Based on the insights I gained from the team, I developed the impression that the limited availability of advanced data tools—particularly the lack of integrated Qlik Sense applications capable of combining multiple KPIs—slowed down the reporting process. This constraint often made it more challenging to generate comprehensive reports, especially those that required more than just raw data.

I was granted access to all relevant internal documentation. I thoroughly reviewed the materials related to the team's tasks and operational procedures. Particular attention was given to documentation outlining the steps for measuring KPIs and preparing reports, as these activities served as the primary means of informing management. Through continuous review of procedural guidelines, I gained a comprehensive understanding of the company's business processes.

To gain a deeper understanding of the tools used in measuring KPIs and preparing reports, an in-depth interview was conducted with a long-standing team member who possessed extensive knowledge of the processes. The interview primarily focused on the company's previous and current reporting procedures.

The interview was conducted in person at the company's offices and held in Serbian. A structured interview guideline and protocol were developed beforehand. To facilitate preparation, the employee received the questionnaire in advance. The interview lasted approximately two hours. The session was recorded and subsequently transcribed. The transcript was then shared with the interviewee for review and any necessary revisions.

Following the initial in-depth interview, I conducted two additional semi-structured interviews with members of the Analytics team: one with a Senior Manager and another with a Supply Chain Performance Manager. These interviews were designed to gain a deeper understanding of the team's operational dynamics and the overall business flow. The semi-structured format allowed for flexibility in exploring key themes while ensuring consistency across both discussions.

Survey: To evaluate the implementation of the Qlik Sense application and gather feedback on the overall process, I conducted a survey among 25 employees within the analytics department at global (8), regional (10), and local (7) levels. The goal was to assess user adoption of the solution and collect their opinions regarding its effectiveness.

Surveys are well-suited for measuring the perspectives of a broader population, making them a valuable tool for this purpose. The survey consisted of 18 questions and was administered

in English via a web-based platform. Upon completion, the survey responses were exported to a Microsoft Excel file and analysed using Excel functionalities. The insights gathered served as an evaluation of the proposed solution and its impact on reporting practices.

5.2 Company overview

The case company is an international pharmaceutical company with its headquarters located in Serbia.

The company was originally founded in the 19th century. Over the years, it has expanded its global footprint by establishing factories and branches across multiple continents. Today, the company operates in more than 100 countries and delivers medicinal products to more than 300 million people annually.

The company's organisational structure is complex and comprises the following primary departments: Production (Manufacturing), Quality, Operations, Research & Development, and Other supporting functions.

The Production Department is responsible for transforming raw active ingredients into finished medical products, followed by packaging to prepare them for distribution. The product range includes various dosage forms such as tablets, capsules, and ampoules.

Production sites are operating from multiple locations:

- Europe: 5 sites
- North America: 2 sites
- Asia: 4 sites
- South America: 4 sites

Each production site is managed by its own local manager. However, all locations operate in alignment with the company's core values, standards, and operational guidelines.

The Quality Assurance Department is responsible for ensuring the quality and safety of all pharmaceutical products intended for market distribution. Their role is critical to the company, as they safeguard the integrity and reliability of medicines delivered to patients worldwide.

The department is established in every country that hosts a production site or a company office, ensuring consistent oversight across all operational locations. Quality Assurance is governed by both global and local management teams, enabling adherence to international standards while addressing country-specific regulatory requirements.

The Operations Department ensures that manufacturing equipment and facilities operate efficiently and reliably, allowing all production processes to proceed according to plan. Its primary responsibilities include maintaining optimal plant operations, overseeing technical

services, and implementing control systems that support consistent product quality and performance.

Key Functions:

- Equipment and facility maintenance
- Technical services support
- Process control and systems oversight

The Research & Development (R&D) Department plays a vital and strategic role in the company's success. It is continually focused on innovation, enhancing existing products, and developing new technologies. By driving scientific progress and implementing forward-thinking solutions, R&D strengthens the company's market position and promotes long-term competitiveness.

Core Objectives:

- Discover and develop new pharmaceutical products
- Improve existing formulations and manufacturing processes
- Foster innovation through scientific research and technical advancement

Other departments - This category encompasses several essential support functions, including Supply Chain, Logistics, Finance, Marketing, and Human Resources (HR). These departments collectively ensure the smooth operation of the company beyond manufacturing and R&D.

- Supply Chain & Logistics: Responsible for sourcing, production planning, and efficient distribution of medicines to markets worldwide.
- Finance: Manages the company's financial planning, budgeting, and overall economic health.
- Marketing: Oversees the promotion and brand positioning of the company's products to stakeholders, healthcare professionals, and consumers.
- Human Resources: Handles recruitment, employee development, and ensures alignment with company culture and values.

The company employs over 20,000 individuals across more than 100 markets worldwide, reflecting its broad international presence. To ensure seamless operations, both global and local management teams work in coordination.

Communication originates from top management and is relayed to local managers, who tailor the messages to fit regional contexts and share them with employees. While there may be slight variations due to local regulatory requirements, the company maintains universal processes and standards across all global markets. During key events or important company updates, information is disseminated through video sessions and virtual meetings. These provide employees with an opportunity to hear directly from senior leaders, ask questions, and strengthen their connection to the company's values.

To ensure that employees across all global markets follow consistent procedures, the company regularly conducts training sessions for all staff. These sessions serve multiple purposes:

- Core Business Training: These mandatory programs cover the company's values, goals, and operational standards, fostering a unified understanding of its mission and guiding principles.
- Role-Specific Training: Tailored courses provide employees with the necessary skills and knowledge for their specific roles, ensuring efficient and compliant performance.
- Optional Development Programs: In addition to required training, the company offers voluntary learning opportunities. These enable employees to expand their competencies, enhance personal growth, and pursue interests beyond their immediate job functions.

This structured approach to training ensures that the workforce remains aligned, agile, and continually evolving in a fast-changing industry.

To enhance cross-functional understanding, the company organises guided visits to production facilities for office-based employees. These visits serve as a valuable training method, allowing staff who are typically removed from frontline operations to gain first-hand insight into production workflows.

5.3 The role of supply chain management in a selected company

The Supply Chain function falls under the company's "Other Activities" or support departments. It is comprised of several interconnected sub-departments, each playing a critical role in ensuring the efficient production and delivery of medicines to global markets:

- Material Planning - Responsible for determining what materials are required and in what quantities to support scheduled pharmaceutical production. Ensures timely delivery of materials to the appropriate production sites.
- Customer Service - Serves as the primary link between affiliates and production sites. Oversees order management, demand planning, and coordination to meet market needs.
- Warehouse - Manages the receipt, storage, and dispatch of both raw materials and finished pharmaceutical products.
- Distribution & Logistics - Handles the transportation and distribution of medicines and materials, ensuring timely and secure delivery across global markets.
- Global Procurement Department - Oversees supply chain operations in countries where the company does not maintain direct affiliate offices. Responsible for sourcing and supplier management in these regions.
- Packaging & Labelling Department - Manages the technical aspects of product packaging, including compliance with labelling regulations and product integrity standards.

- Product Management Department - Supervises the entire lifecycle of pharmaceutical products—from initial launch through growth, maturity, and eventual retirement.
- Analytics Department - Provides data-driven insights and performance reporting to support strategic decision-making across the company.

Most departments within the Supply Chain are structured to operate at both local and global levels, with dedicated management and teams leading initiatives specific to their scope. This dual-level approach ensures responsiveness to regional needs while aligning with the company's global strategy. Taking the Analytics department as an example, the local Analytics team prepares reports relevant to the country in which they operate, supporting local supply chain activities and management. The Global Analytics team compile data across markets to create strategic reports used by company leadership.

Efficient communication is a cornerstone of the Supply Chain's success. The company ensures that strategic insights, updates, and directives reach every level of the organisation through structured channels. Information from top management is communicated to team managers, who then relay it to their respective teams to ensure alignment across operations. In addition to this hierarchical communication flow, the company organises dedicated online sessions exclusively for Supply Chain employees, providing them with insights into the current organisational landscape and offering a platform to ask questions and engage directly with strategic updates.

The Global Analytics team is not directly involved in the production of medicine. Their primary responsibility is tracking the company's business performance by managing and analysing enterprise-level data. They prepare various types of reports and presentations, which can be categorised into ad-hoc reports—requested by top management as needed—and regular monthly reports. This responsibility is distributed among team members.

Two key reports are prepared monthly for top management, focusing on tracking multiple KPIs by country (market) and production site. These reports reflect the company's performance for the relevant month, offering leadership clear visibility into both regional and site-level success. Given their strategic importance, accuracy and timely delivery are critical. The reports are compiled in Microsoft Excel, using data exported from Qlik Sense applications, Excel spreadsheets stored on SharePoint, and SAP. However, due to the highly manual nature of this process—merging data from various sources into a single Excel file— the potential for errors has increased and has already manifested in practice.

The Analytics team utilises several tools, including Excel, Qlik Sense, Alteryx, SAP, and Power BI. While Qlik Sense is available, its use within the team remains limited; many reports continue to be developed in Excel—even those that could be streamlined through automation in Qlik Sense. Increasing adoption of Qlik Sense would significantly reduce the potential for errors, expedite the report preparation process, and enhance the clarity and presentation of data.

6 DIGITALIZATION PROCESS IN SELECTED PHARMACEUTICAL COMPANY

6.1 Key performance indicators

Performance metrics, also known as KPIs, provide a comprehensive view of the supply chain and aid in evaluating the execution performance and the accuracy of the supply/demand plan (Anand & Grover, 2013, p. 136).

In the selected company, numerous KPIs are monitored at both local and global levels. The Analytics department is responsible for tracking and visualising these KPIs. This master's thesis focuses specifically on KPIs measured at the global level, which serve to inform top management about the overall state of the company's business performance. To preserve confidentiality, the names of the KPIs presented in this thesis have been modified.

Some of the KPIs measured on a global level include Service Performance, Out-of-Stock Rate, Compliance Rate, Stock Holding Period, and Product Stock, among others. Each employee in the Global Analytics team oversees one or more KPIs, measuring and visualising them.

Service Performance

The Service Performance KPI assesses overall customer satisfaction with the company's products. It provides insights into customer sentiment, including the percentage of customers willing to recommend the products to others. Additionally, it breaks down satisfaction levels by market and product category (e.g., tablets, ampoules).

This KPI also evaluates whether the company meets its annually defined target values across the entire product delivery process—from production to the end customer.

Data collection is conducted through the SAP system, which consolidates input from all markets. Using SAP BI, relevant data is extracted into a Microsoft Excel file and then merged with additional market-specific information. Before publishing, the consolidated file undergoes a final review and adjustments by the employee responsible for overseeing that KPI.

This is a "Monthly KPI," typically monitored in the second week of each month.

Out of Stock Rate

The Out of Stock Rate is an inventory-related KPI that indicates how frequently the company experiences stockouts. It helps identify the optimal inventory levels required in each market to ensure sufficient product availability and minimise the risk of stockouts. A high stockout rate may lead to lost sales, dissatisfied customers, and damage to the company's reputation.

This KPI is monitored using the SAP system. Data is extracted through the SAP BI connector into a Microsoft Excel file, where it is sorted, adjusted, and prepared for publication. The process includes integrating data from relevant sources and performing final quality checks to ensure accuracy.

Given its operational importance and the need for continuous oversight, the Out of Stock Rate is tracked every week.

Stock Holding Period

The Stock Holding Period KPI measures the number of months of inventory coverage the company has across its markets. It compares the available stock at affiliates to the forecasted monthly volume. For example, if the current inventory is 500 units and the monthly forecast is 100 units, the company is covered for five months.

This KPI relies on data provided by individual countries reflecting inventory levels in each market. These figures are then processed using predefined formulas in Alteryx, which calculate the coverage period based on product type, market, and other relevant criteria.

The stock holding period is tracked monthly and includes revenue impact metrics, indicating the financial implications—either gains or losses—associated with the duration of inventory coverage.

6.2 Qlik Sense as a data analysis tool

6.2.1 Qlik Sense applications

Qlik Sense is a data visualisation tool that supports the creation of personalised, interactive reports and dashboards using data from multiple sources. There are several deployment options available, including:

- Qlik Sense Desktop: A Windows-based application for individual use.
- Qlik Cloud: A cloud-based solution hosted by the company.
- Qlik Sense Web: A web-based platform.

In this thesis, references to Qlik Sense will relate specifically to Qlik Sense Web, as implemented by the company.

The Global Analytics team is responsible not only for measuring KPIs, but also for visualising the results. This team manages four Qlik Sense applications, which serve as key platforms for publishing business insights and information. Team members oversee the end-to-end process, which includes measuring KPIs, preparing and reviewing data, making necessary adjustments, and publishing the information via Qlik Sense.

As most KPIs are monitored monthly, publishing in Qlik Sense typically occurs on a monthly basis. The platform offers dynamic and versatile visualisation capabilities, allowing data to be presented through a wide range of formats—including charts, tables, maps, buttons, and containers. Its features enable rapid customisation and updates to visualisations as needed.

One of Qlik Sense's notable strengths is its ability to integrate data from multiple sources across various time periods, which empowers users to locate and analyse relevant information quickly.

Visualised data within Qlik Sense applications serves a wide range of purposes for both employees and management. For top management, the platform offers clear and easily accessible visualisations that provide a quick overview of the business situation—greatly supporting the decision-making process. Each application typically contains multiple sheets with various filters, sorting options, and visualisation styles, enabling management to explore different data dimensions and gain comprehensive insights efficiently.

Employees also benefit significantly from Qlik Sense, using it to access data for report preparation, business analysis, and operational understanding. In interviews with three members of the Global Analytics team, they emphasised the value of Qlik Sense applications in their daily workflows. They highlighted the ability to export relevant data from one application and combine it with information from other apps or external sources when needed. According to their experience, using Qlik Sense during report creation saved them a substantial amount of time.

Figure 2 displays user activity data related to the Qlik Sense applications developed by the Global Analytics team. The data spans the period from June 5, 2024, to February 11, 2025, capturing both overall user engagement and application-specific activity.

Key insights presented include:

- Total number of sessions recorded during the specified timeframe
- Count of unique users, typically individuals using the applications for daily or monthly operational tasks
- Recent user activity, including the number of users who accessed the applications within the last 7, 30, 60, or 90 days
- Volume of data exports generated through the applications
- Number of days since each application's last update
- Details of the most recent usage, expressed in days, hours, and minutes

Figure 2 demonstrates that the Qlik Sense applications are consistently used, as indicated by the "Last Used Ago" column. The high volume of data exports also highlights active engagement across the organisation. Furthermore, it is evident that two applications, Service Monitor and Stock Shortage Tracker, have notably higher numbers of users and sessions compared to the other two. These two tools are widely adopted across multiple departments

and were the first applications developed by the Analytics team, contributing to their broader utilisation and familiarity among employees.

*Figure 2: User Activity Tracker*

App Name	Sessions	Users	Users Last 7 Days	Users Last 30 Days	Users Last 60 Days	Users Last 90 Days	Exports	Days Since Last Reload	Last Used Ago (Day Hour:Min)
	5,911	313	78	190	220	261	131	-	0 01:48
Service Monitor	2,461	211	36	126	142	175	83	1	0 08:22
Coverage Tracker Dashboard	279	58	9	26	30	41	1	3	1 14:33
Stock Shortage Tracker	2,273	216	46	122	142	175	35	4	0 01:48
Inventory Duration Tracker	898	83	10	42	49	60	12	26	0 14:27

Source: Adapted from Qlik Sense (2025).

In addition to the applications developed at the Global level, the Analytics team on the Local level has also created Qlik Sense tools tailored to specific market needs. These locally developed applications focus on tracking data relevant to individual regions and differ in scope and functionality from those designed for global reporting.

Out of the four Qlik Sense applications managed by the Global Analytics team, I will present two: Service Monitor and Stock Shortage Tracker. To maintain the company's confidentiality, the actual names of the applications have been changed, and the graphic elements represented in figures 3 and 4 are illustrative examples that have been visually modified. They do not reflect actual company data and are intended solely for demonstration purposes.

Figure 3: Service Monitor Application
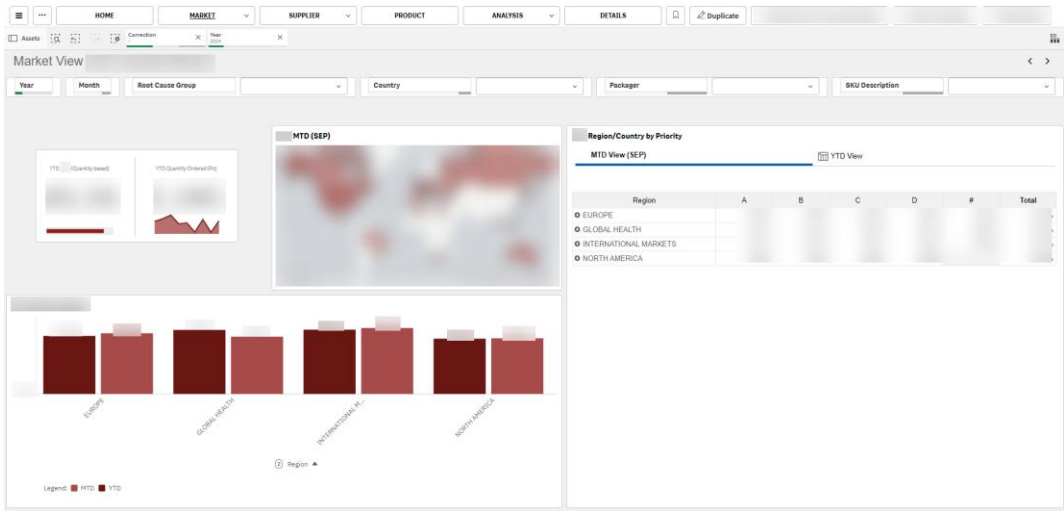
Source: Adapted from Qlik Sense (2024).

The Service Monitor application (figure 3) is designed to track the Service Performance KPI, which reflects overall customer satisfaction. This metric is displayed both as absolute values and percentages, enabling comparison with predefined targets.

Customer satisfaction data is segmented across various levels, including market view, supplier view, and product view. These segments are organised in separate sheets, each equipped with preconfigured filters to streamline data navigation.

Every sheet within the application features intuitive tables, charts, and filter panes, making the information easily accessible and readable for users across different departments.

Figure 4: Stock Shortage Tracker Application
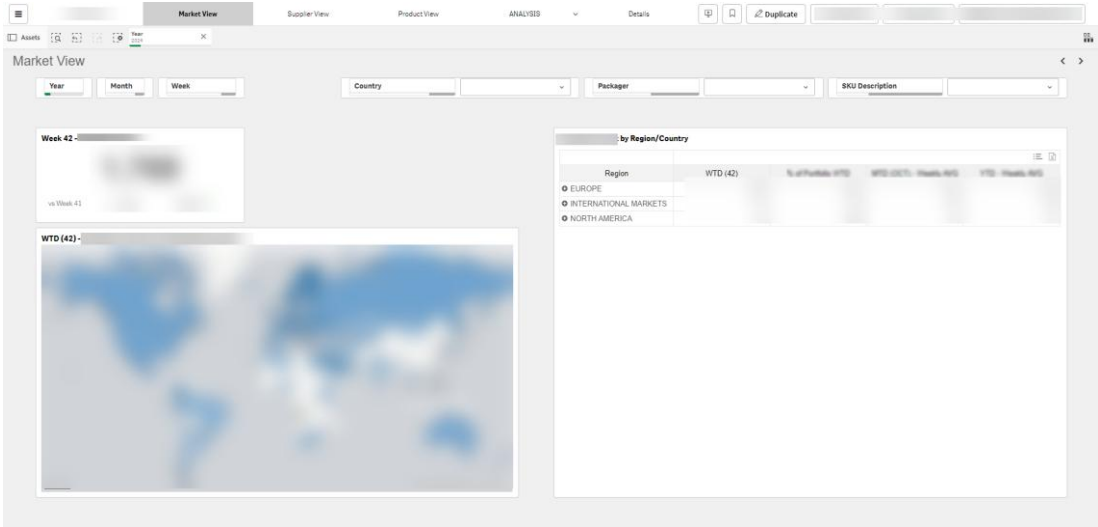
Source: Adapted from Qlik Sense (2024).

The Stock Shortage Tracker (SST) application (figure 4) monitors the Out-of-Stock Rate KPI across different markets. As this KPI is measured weekly, the application is updated accordingly with the most recent data.

It presents stock levels for the latest measured week, expressed in both units and percentages. Through various filters and sheets, users can easily access information for specific markets and product categories. The application's multi-sheet design provides a comprehensive overview of the stock situation, enabling timely decision-making and informed inventory planning.

6.2.2   The use of applications in the company

The Global Analytics team has developed four Qlik Sense applications tailored to support both internal reporting needs and broader organisational access to analytical data. Team members primarily use these tools to generate performance reports, but they are also made available to employees from other departments who rely on analytical insights to support their daily or monthly tasks.

Table 1 presents a list of applications developed by the Analytics team, along with the corresponding number of users month to date (MTD – from the beginning of the month until the current date/date when the table was created). These applications are utilised by both the

Analytics team and employees from other departments. Each Qlik Sense application maintains a usage record, allowing application owners to monitor the exact number of individuals who accessed it during the previous month. The Service Monitor app is the most widely used, as it provides critical information relevant to various stakeholders—some rely on it for reporting. In contrast, others use it to obtain specific operational insights. In contrast, the Inventory Duration Tracker contains revenue-related data and has restricted access, which results in a lower number of visits.

Table 1: Qlik Sense applications usage

Qlik Sense Application	No. of users of the application MTD
Service Monitor	113
Stock Shortage Tracker	87
Coverage Tracker Dashboard	20
Inventory Duration Tracker	23

Source: Own work.

Qlik Sense applications have been in use within the company since 2019, although the Analytics team did not initially manage them. Management of Qlik Sense transitioned to the Analytics team following the arrival of two new colleagues, one of whom was a Qlik Sense expert. This expertise enabled the team to set up their first internally managed application, the Service Monitor. The shift in responsibility occurred after the previous global team overseeing Qlik Sense was discharged, positioning the Analytics team as the primary group responsible for its ongoing maintenance. Since taking over, the team has developed three additional applications and currently manages a total of four Qlik Sense applications.

Managing applications was a new responsibility for the team, and a new colleague (Qlik Sense expert) took the lead in developing and managing two applications. He was also supporting two other colleagues in the process of creating two other applications. One interviewee, who had assumed a new role as an application owner, described the experience of building an application from scratch as both exciting and challenging. She received guidance from a more senior colleague, used online tutorials, and highlighted that the most challenging part was communicating with management—particularly the time it took to finalise the application's design and features. Despite being a beginner in the field, she completed the entire process in just under three months, which she considered impressively fast.

Another interviewee has a slightly different experience. She was assigned to create a Stock Shortage Tracker app. Due to frequent changes in management preferences regarding the

application's appearance, the need to connect a variety of data sources, and the concurrent need to learn how to do so, alongside her regular tasks, it took her over 6 months to prepare the application, even with the support of a senior colleague. She states that it is now much easier to maintain the app regularly, and that she gained a lot from that experience, but remembers that period as hectic.

The process of managing Qlik Sense applications involves several key steps to ensure their functionality and relevance (figure 5):

- Creating the Application - Setting up a new application within the Qlik Sense platform, tailored to specific analytical needs.
- Regular Updates - Maintaining the application's accuracy by performing weekly or monthly data updates.
- Implementing Modifications - Adjusting and enhancing the application as needed— whether based on user feedback, evolving business requirements, or technical improvements.

Figure 5: Flow from creating to using application
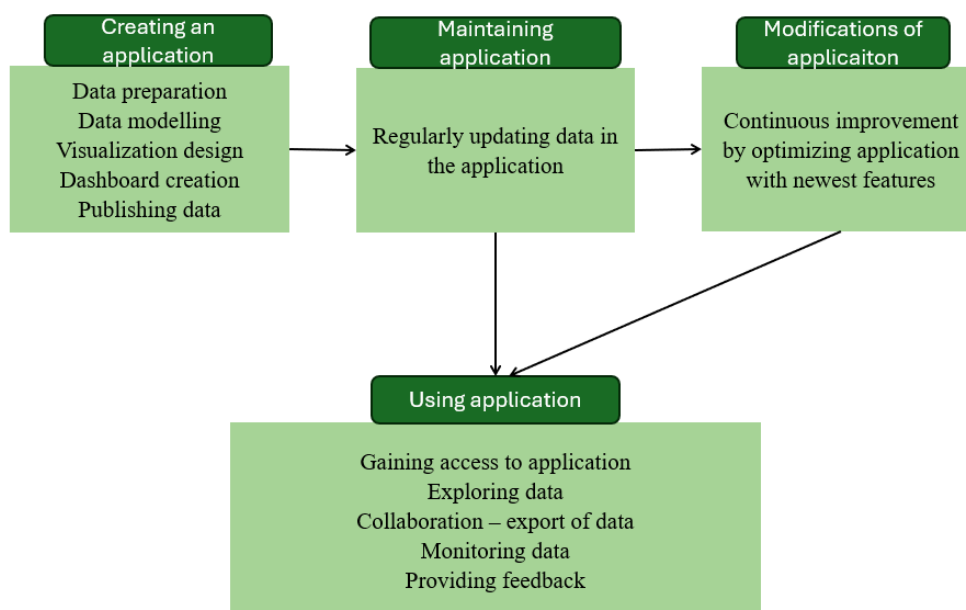
Source: Own work (2025).

The first step in the process is creating the application, and this experience varied among the different application owners. The employee, who had prior experience from the previous team managing Qlik Sense, was already familiar with the setup and did not encounter major issues. In contrast, two other employees—who had previously been users rather than developers—faced a learning curve as they took on their new roles as application owners. Throughout the journey of creating the application, they received support from a knowledgeable colleague within their own team as well as assistance from other

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departments. Despite the initial challenges, both acknowledged the significant value of the experience, emphasising the personal growth it offered as they transitioned into a more technical and strategic role.

Once an application is finalised and published for use, the owner is responsible for ensuring the accuracy of the data it displays. Of the four applications, three require monthly updates and one requires weekly updates. The updating process varies: some applications require adding a new data source for the respective period and validating its accuracy, while others are configured to update automatically. Before releasing the updated application to users, a mandatory data validity check is performed. This includes cross-verifying the displayed data with the original source, comparing it with data from the previous month or week, and reviewing it against other reliable reports. Only after passing these checks is the application made available with the latest data.

The modification of Qlik Sense applications can be initiated by managers, end users, or application owners themselves.

- Users often suggest enhancements such as additional sheets featuring specific tables or graphs to streamline their work or propose changes to existing visualisations for more precise data representation. These suggestions are discussed with the manager of the Analytics team, who ultimately decides whether the modifications will be implemented. Such user-driven requests are most frequent shortly after an application is initially published; over time, the need for changes tends to decrease.
- In addition to user input, mandatory updates are required at the end of the year—or in some cases, at the end of each quarter—necessitating adjustments to the application structure or content.
- Owners also have the autonomy to introduce improvements independently.

Most frequently mentioned advantages of Qlik Sense applications are:

- Their dynamic setup, which includes multiple sheets, tables, and filters, allows users to search and display the exact information they need in a format that suits them best.
- The platform's "storage" function enables users to quickly retrieve historical data without having to sift through multiple Excel files or other sources.
- Visualisations in Qlik Sense stand out, helping users interpret data more efficiently.
- Applications consistently deliver reliable insights as they are the primary source of accurate and up-to-date information.
- For application owners, an additional benefit has been personal growth in data analytics through learning to maintain and develop applications within the tool.
- The platform's flexibility is especially valuable for large companies that often undergo organisational restructuring or product reclassification, as remapping within Qlik Sense is easily achievable—unlike in static Excel files where such adjustments would be far more complex.

Among the commonly mentioned drawbacks of Qlik Sense applications, owners often highlight the prolonged wait times during data reloads—especially when working with large-scale applications that contain extensive datasets. Additionally, setting up complex applications that integrate multiple data sources can be time-consuming and require a high level of technical effort.

Within the Analytics team, report preparation is generally divided into two categories: ad-hoc reports, which are created on demand to address specific questions or tasks, and regular monthly reports, which are produced consistently to track predefined KPIs and operational metrics.

Ad-hoc reports vary depending on specific business needs and often require different analytical tools for each case. In this process, applications are crucial for the Analytics team as they enable efficient data exports, allowing integration with other sources for deeper analysis. These applications consolidate data from multiple platforms, saving time and effort when preparing reports, and include archived datasets that simplify comparisons—such as goal versus current state or month-over-month evaluations—ultimately streamlining workflows and supporting faster, data-driven decisions.

Qlik Sense applications play a significant role in supporting the Analytics team's workflow, particularly in the preparation of regular monthly reports and presentations. Their value is often reflected in the time saved during report development. According to one interviewee, while the introduction of Qlik Sense did not alter her process for certain reports, it led to substantial time savings for others. She highlighted one specific report where the use of the application has reduced her monthly workload by approximately 6–7 hours, underscoring the efficiency gains that Qlik Sense can deliver when effectively integrated in daily tasks.

One particularly important presentation prepared monthly by the Analytics team for the leadership group consists of more than 60 slides and involves contributions from all team members, each responsible for a specific portion. Throughout this process, the team relies heavily on Qlik Sense applications, recognizing their role in enhancing both speed and accuracy. By incorporating multiple data sources, these applications enable users to work with pre-integrated datasets, eliminating the need for manual merging and reducing the risk of errors. The published data within the applications has undergone multiple validity checks and is considered official, further reinforcing its reliability. Additionally, the built-in data archive supports the development of trend-based slides—such as comparisons between goals and current outcomes—making Qlik Sense a crucial tool in producing high-quality, insight-driven presentations.

To further expedite the presentation-building process, the team often prepares dedicated sheets within Qlik Sense applications containing the exact graphs needed for their slides. This allows team members to directly duplicate visuals into their slides, saving considerable time and ensuring consistency. However, a challenge arises from the limited number of

available Qlik Sense applications that support this level of efficiency. In cases where suitable applications are lacking, the team reverts to using Excel files and manually prepares the visual content, which is more time-consuming and increases the risk of inconsistencies or errors.

Beyond the preparation of reports and presentations, regular tasks within the team are distributed among members based on their focus areas. Most team members are primarily responsible for tracking KPIs, while a dedicated group of three individuals oversees the management and upkeep of Qlik Sense applications. Additional responsibilities related to data analysis are allocated according to each employee's expertise. A monthly deadline— typically set by senior management for publishing data either within the applications or on SharePoint—is scheduled for the end of the second week. Under normal circumstances, the team meets this deadline consistently. However, any delay in publishing can disrupt workflows and negatively affect team members who depend on the data to complete their own tasks.

Many team members agree that expanding the number of Qlik Sense applications would bring clear benefits. One key reason is that several important KPIs currently lack dedicated applications, which forces analysts to manually search across multiple data sources to compile the necessary information for reports. This not only slows down the reporting process but also introduces complexity and potential for error. Developing additional Qlik Sense applications tailored to these KPIs would streamline the workflow, enable automation of repetitive tasks, and significantly simplify data retrieval—ultimately improving efficiency and accuracy across the team's operations.

An application that consolidates multiple KPIs would greatly streamline the preparation of critical monthly reports, particularly those focusing on metrics by country and production site. By centralizing data, this solution would eliminate the need to manually combine information from separate sources and applications, saving substantial time and enhancing overall efficiency. Users across the team would benefit from having all KPIs accessible in one place, allowing for faster data exports and simplifying their reporting workflows. According to team members, such an integrated application would significantly improve the process of monitoring diverse KPIs, while also serving top management—who typically use applications solely for data tracking—by offering a unified view of key metrics in a single interface.

The overall sentiment within the team is that completing both ad-hoc and regular tasks currently involves a combination of automated and manual processes. While some analytical procedures benefit from automation, others still require significant manual effort, particularly when compiling data from multiple sources. Team members believe there is clear room for improvement and advocate for increasing the use of Qlik Sense applications and Alteryx workflows to automate repetitive tasks—rather than introducing entirely new data tools. Notably, three employees have gained hands-on experience in developing Qlik

Sense applications, which positions the team well to create new solutions more efficiently. This approach is expected to accelerate workflows over time and lead to substantial time savings.

6.3   Development of Global KPI application

### 6.3.1   The development process of the Global KPI application

The manager of the Analytics team came up with the idea for a new application after closely observing the team's workflows and the time invested in conducting various analyses. Recognizing the opportunity to streamline processes, she introduced a new project to the team: the development of an application designed to track multiple KPIs in one centralized platform. Following the proposal, the application was successfully developed and launched after 7 months.

During the initial meeting, several key decisions were made regarding the development of the new KPI tracking application:

- Purpose: The application was intended to replace two extensive and time-consuming monthly reports—KPIs per Country and KPIs per Site. By centralizing data, top management could access performance metrics quickly, without waiting for reports to be manually prepared by team members.
- Content & Scope: It would consolidate various KPIs, including those already tracked via existing Qlik Sense applications, as well as additional metrics not yet digitalized. The application would present KPI data with filtering options based on country and site, offering a comprehensive yet flexible view.
- Usability & Design: A core requirement was simplicity. The interface needed to be intuitive and easy to read, without sacrificing the richness of the data presented.
- Target Users: The primary users would be members of the Analytics team and top management. However, the platform would also be available to other employees who could benefit from the insights provided.
- Timeline: Defined timeline was 6 months.

At the start of the development phase, the team focused on configuring the load script, which acts as the backend engine of the application by pulling and organizing data for display. Since each application has distinct data needs, load scripts vary in complexity and content; in this case, the script was structured into multiple sections. The initial setup included adding a main section to define the core framework, a change log to document each version release, and detailed mapping for countries and packaging sites to ensure accurate regional and platform categorization. Figure 6 displays the layout of the developed load script. It features graphic elements that serve as an illustrative example, which have been visually adjusted for demonstration purposes and do not represent actual company data.

Figure 6: Load script of KPI Global application
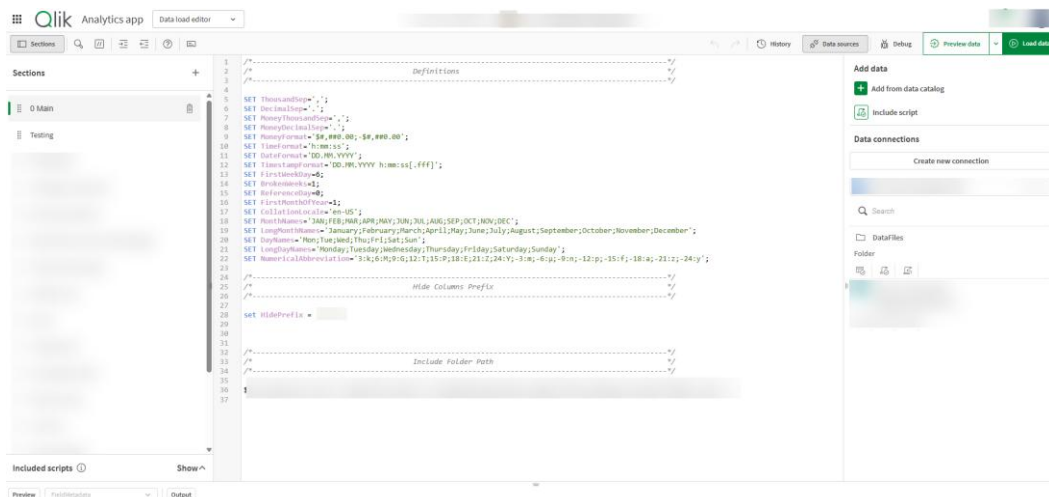
Source: Adapted from Qlik Sense (2025).

Once the foundational load script was in place, the team began incorporating KPIs into the application, carefully organizing each metric within its own section of the script. The process started with four KPIs that were already being tracked through existing Qlik Sense applications; thanks to their pre-established scripts and verified data sources, these KPIs could be efficiently replicated and integrated into the new KPI Global application.

Integrating the remaining KPIs into the application proved to be a complex and demanding task. While some KPIs pulled data from a single source and were relatively easier to implement, still requiring thorough validation, the real challenge arose with KPIs that relied on multiple data sources. For these, the team had to design a unique, centralized data feed that could serve the application reliably. Given that each KPI had distinct requirements, their implementation had to be treated as a standalone process. To manage this, the team turned to tools like Alteryx, developing custom workflows to produce clean, structured documents suited for ingestion into the app. These workflows involved detailed steps such as analysing, cleaning, filtering, sorting, and finally joining the relevant datasets. Once completed, every output was rigorously checked and corrected to ensure accuracy and integrity before being added to the application.

Despite balancing their ongoing monthly responsibilities, the Analytics team dedicated significant effort to the development of the KPI Global application, often working with limited availability. The bulk of the development timeline (5 months) was consumed by data implementation, which involved integrating and validating complex datasets. Once this phase was complete, attention shifted to visualizing the data effectively. Given the application's goal of replacing two comprehensive reports, the team opted to design a single sheet that consolidated all KPI information. Due to the sheer volume of data, a structured table format was chosen for clarity and accessibility. To mirror the original reports, two

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distinct containers were created within the sheet: one displaying KPIs by Site, and the other KPIs by Country.

They first focused on container containing data per packaging site. Dimensions were added – packager (site) and platform, while measures were all the KPIs that were added to the application and were measured in the Excel report that was prepared. Colour coding was added for better understanding (green/red coloured fields in comparison to target). The challenge in this process were production sites that were no longer part of the company but were mapped as they belong to some of the platforms. The management explained that although those sites are not officially within the company, some of the company's stock is still there. The team remapped them and placed them into another category aside to official platforms.

The team also developed a dedicated container for visualizing KPIs by country, designed specifically to replace the previously used Excel-based report. This container included hierarchical dimensions—regions, clusters, and countries—to provide a clear and organized structure for navigating the data. To support rapid comprehension and intuitive analysis, colour coding was applied here as well, maintaining consistency with the site-level container and enhancing the overall user experience.

A common challenge emerged when certain packaging sites or countries were only tracked by one or two KPIs, which led to blank cells in the table when data for other KPIs was unavailable. Although the team explored various options to address these gaps, including consultations with colleagues, they ultimately chose to retain the blank spaces in favour of maintaining data integrity and accuracy. To improve the overall visual presentation, they adjusted the default sorting so that European countries (which did not have that issue) appeared first, correcting an inconsistency in the initial layout. A similar approach was taken in the site-level container, where one key platform was prioritized at the top of the sorting order to reflect its strategic relevance. The example of this is represented in figure 7 which is illustrative example of this case that is adjusted for demonstration purposes.

Representing both monthly and weekly KPIs within a single table introduced a challenge, particularly due to the inclusion of the Stock Shortage Tracker—the only KPI measured on a weekly basis across both sites and countries. If the application were updated only once a month, the data for this metric would quickly become outdated and inaccurate. Adding to the complexity, the Stock Shortage Tracker used percentages and not absolute units. This difference in frequency and format meant the team had to carefully design the data structure to ensure consistency while preserving the integrity of the data displayed.

After completing the two initial containers, the team needed to incorporate targets for each platform and region. Their first idea was to embed this information directly into the existing tables within the two containers. However, after extensive brainstorming, they concluded

that doing so would compromise readability in the main tables. Ultimately, they decided to add two additional containers specifically dedicated to presenting the target data.

Figure 7: Blank fields in the Dashboard
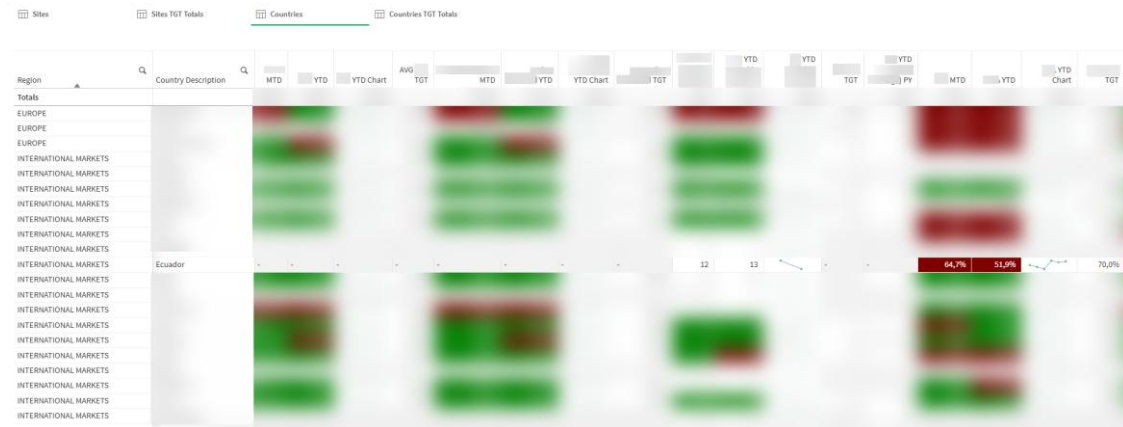
Source: Adapted from Qlik Sense (2024).

Following the meeting with the manager, the content and structure of additional sheets for the application were finalized. Drawing on her experience working with top management and cross-functional teams, she proposed the inclusion of six new sheets, plus a Help & About sheet, to enhance usability and support various stakeholder needs:

- Home Sheet**:** Serves as the landing page for the application. Its key role is to provide direct shortcuts to the Platform and Country sheets, ensuring a streamlined user experience.
- KPI View**:** Displays the five most-tracked KPIs graphically over a one-year period. This sheet is tailored for top-level and platform-specific management who require a quick overview of KPI trends.
- KPIs Tabular View**:** Allows users to select desired dimensions while KPIs (measures) remain pre-defined. This setup enables dynamic creation of pivot tables, supporting personalized data exploration.
- Advanced Analytics on KPIs**:** Developed in response to top management's request, this sheet facilitates comparative analysis of two KPIs across platforms, supporting deeper strategic insights.
- Global Scorecard: Summarizes values of the five key KPIs by month.
- Custom Report**:** Empowers users to choose both dimensions and measures, generating tailored tables which can be exported for further analysis.
- Help & About Sheet**:** Provides essential metadata and support information, including: date of initial creation, last data reload timestamp, application owners, contact points for issue resolution, current application version and access instructions.

Before the application was published, several key steps were taken to ensure accuracy and readiness. Most importantly, a thorough data verification process was initiated. The first round of checks was carried out manually by the app developers, who exported the data into an Excel file and compared it directly with the main data sources. This step was essential to confirm consistency and identify any discrepancies early on.

Following this, the internal project team conducted a second layer of verification. Team members cross-checked the application's data against reports from the previous month. This internal review allowed the team to preview the application before broader release and make recommendations for any final adjustments. Their proactive involvement also ensured smoother user experience for others once the app went live.

After all checks were complete and the manager provided final approval, the application was ready for launch. The manager wanted the project team to showcase their work, so she designated them as the presenters. This decision gave the team a well-deserved spotlight and strengthened their sense of ownership.

Invitations to the presentation were sent to all Supply Chain team leads, who were asked to forward them to employees. The app was published shortly before the event began, enabling attendees to explore it in real time during the 30-minute presentation. To reinforce key information, a PowerPoint summary was created and distributed to all participants after the meeting.

6.3.2   The benefits of Global KPI application

The Global KPI application was primarily developed to replace the manual preparation of two extensive monthly reports—one detailing KPIs by country and the other by production site. Previously, these reports were compiled using Microsoft Excel and involved tracking a wide array of performance indicators across various regions, countries, and individual production sites. The manual process was not only time-consuming but also prone to inefficiencies and errors. By shifting to an integrated application, the team aimed to streamline data handling, enhance consistency, and improve accessibility for decision-makers.

The KPIs per country report was specifically prepared for top management and held considerable strategic importance. Once the file was completed, a team member would forward it to the manager, who in turn shared it with the appropriate representative from senior leadership. Punctuality was critical, as the data directly informed discussions during the monthly top management meetings where the company's performance and overall situation were reviewed. Given its role in driving decisions at the highest level, maintaining absolute accuracy in the data was essential.

Figure 8: KPIs per Country report

Source: Adapted from Excel file (2022).

Figure 8 illustrates the layout of the Excel file used for monthly reporting. To ensure confidentiality, all content has been thoroughly anonymized: numerical values were randomly assigned to randomly selected countries, formatting was arbitrarily applied, KPI names were altered, and certain countries were intentionally excluded from the dataset. This figure does not reflect actual company data.

For each KPI, the table presented three core components for performance assessment: the actual values from the previous month, the year-to-date cumulative performance up to that month, and the annual target. Since the underlying data changed each month, accuracy was crucial. If an employee detected any major discrepancies during the report's preparation, they were expected to notify the manager.

The KPI per site report was tailored for upper management, specifically the leader of two out of the three operational platforms. Each platform encompasses multiple production sites, and once the report was finalized, it was sent by an employee to the respective platform head. This leader would then discuss the insights during the monthly meetings with top management.

Figure 9 illustrates the layout of one sheet from the original Excel file—though all the displayed data, including production site names, KPI labels, and numerical values, has been altered and do not represent actual company data. Each KPI was assigned its own sheet, tracking performance metrics per production site. Column headers represent key monitoring parameters: current year's target, monthly figures for the quarters of the current year, and values from the most recent month.

Figure 9: KPIs per Site report

Production Sites	TGT22	YTD Jan	YTD Mar	YTD Jun	YTD Sep	MTD Oct	YTD Oct
Production Site 1	1%	2%	2%	2%	2%	2%	2%
Production Site 2	2%	3%	3%	3%	3%	3%	3%
Production Site 3	3%	4%	4%	4%	4%	4%	4%
Production Site 4	3%	4%	4%	4%	4%	4%	4%
Production Site 5	5%	6%	6%	6%	6%	6%	6%
Production Site 6	6%	7%	7%	7%	7%	7%	7%
Production Site 7	7%	8%	8%	8%	8%	8%	8%
Production Site 8	8%	9%	9%	9%	9%	9%	9%
Production Site 9	9%	10%	10%	10%	10%	10%	10%
Production Site 10	5%	11%	11%	11%	11%	11%	11%
Total Platfrom 1	**7%**	**12%**	**13%**	**14%**	**15%**	**16%**	**17%**
Production Site 11	4%	6%	6%	6%	6%	6%	6%
Production Site 12	6%	7%	7%	7%	7%	7%	7%
Production Site 13	8%	7%	7%	7%	7%	7%	7%
Production Site 14	10%	9%	9%	9%	9%	9%	9%
Production Site 15	12%	10%	10%	10%	10%	10%	10%
Total Platfrom 2	**13%**	**4%**	**4%**	**4%**	**4%**	**4%**	**4%**

Source: Adapted from Excel file (2022).

With the launch of the Global KPI application, the need to manually prepare two extensive and time-consuming Excel reports—KPIs by country and KPIs by production site—has been eliminated. The primary goal during development was to consolidate and automate these reports, resulting in an application that combines their data into a single, streamlined solution.

Designed with usability at its core, the Global KPI application features eight sheets. Figure 10 presents a sample layout that has been deliberately modified for demonstration purposes. Each sheet presents different combinations of tables and charts, which users can tailor using a filter pane to retrieve relevant insights. All sheets are dynamic, continuously displaying the most up-to-date information.

Figure 10: Sheets of Global KPI Application
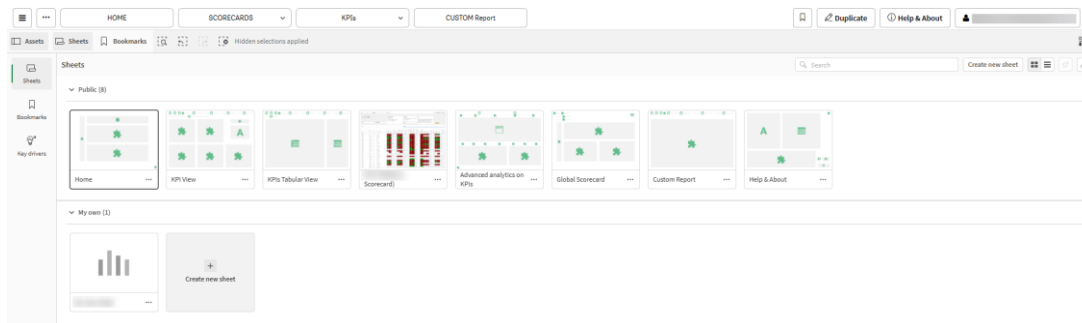
Source: Adapted from Qlik Sense (2025).

These sheets are housed under the "Public" tab, but users have the flexibility to duplicate existing sheets—or even create new ones—within the "My own" tab. This customisation is particularly valuable to users with experience in the Qlik Sense backend, allowing them to fine-tune filters and layouts to meet their specific analytical needs.

The Platform and Country Scorecard sheet served as the cornerstone of the application during its development phase. Additionally, the primary filter pane is located at the top-right corner of the sheet, offering access to all available filters and ensuring intuitive navigation throughout the dashboard. Figure 11 presents the filter pane as an illustrative example that has been visually adjusted for demonstration purposes and does not represent authentic company data.

Figure 11: Filter pane at Global KPI Application
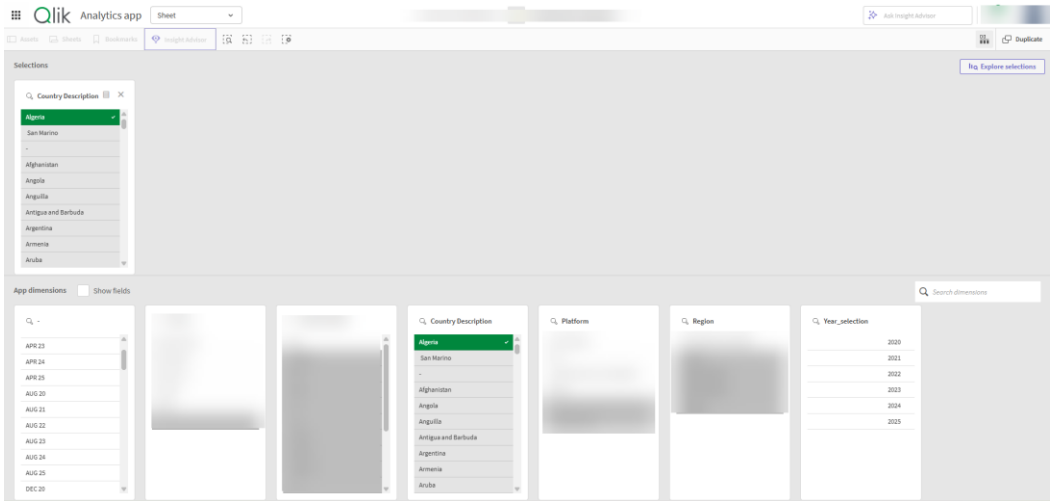
Source: Adapted from Qlik Sense (2025).

Data in the sheet is divided into four containers: Packager and Countries are the main ones.

The Packager container was developed to replace the previously used KPIs per site Excel report. The content is structured as a large table encompassing all KPIs formerly tracked in the Excel report. The first two columns contain the names of the production sites and their corresponding platforms, while the remaining columns are dedicated to the individual KPIs being monitored. This layout ensures that all relevant data is consolidated into a single view, streamlining analysis and preserving the comprehensive scope of the original report. Figure 12 showcases the layout of the Packager container. The visual has been modified for demonstration purposes and does not depict actual company data.

Figure 12: Packager container

Source: Adapted from Qlik Sense (2024).

The Countries container was developed to replace the Excel-based KPIs per country report. Its layout closely mirrors that of the Packager container. The first columns in the table identify each country, its corresponding cluster, and the broader region it belongs to. The remaining columns display various KPIs. Each KPI includes multiple data points used for performance evaluation:

- MTD (Month-to-Date): Reflects the KPI value for the specific month being analysed.
- YTD (Year-to-Date): Shows cumulative performance from the start of the year to the current date.
- Trend Charts: Offer visual representations of KPI performance over time, from January through the latest reporting period.
- Annual Targets: Indicate the set goal for the KPI for the full calendar year.

Figure 13: Target Totals for Countries
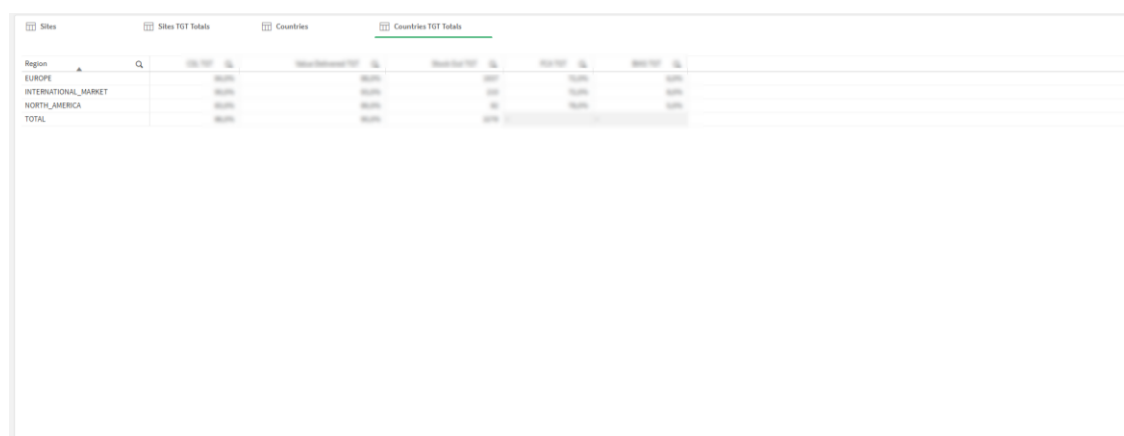
Source: Adapted from Qlik Sense (2024).

Two other containers summarize target data for the selected year. Sites Target Totals displays the annual targets for each platform, aggregated across all relevant indicators. This

provides a clear overview of performance expectations at the platform level. Countries Target Totals presents total targets for each region, offering a regional perspective on overall goals. This allows for easy comparison across geographic zones. Figure 13 represents the layout of the Target container and is adjusted to not represent any company's actual data.

Key features include:

- Archive Functionality: Users can access historical data by selecting specific past dates, eliminating the need for quarterly columns that were previously required in KPI per site reports.
- Flexible Filtering: The sheet allows users to refine their view by selecting any combination of packing sites, platforms, countries, or clusters.
- Weekly Updates: The application refreshes data on a weekly basis, ensuring that even KPIs requiring frequent tracking are up-to-date.
- Excel Export: For further analysis or reporting, users can export data directly to Excel files.
- Visual Status Cues: Each cell is colour-coded based on performance against its target, offering an intuitive visual cue.

From the perspective of platform and other managers, the application offers substantial improvements over traditional Excel-based reporting:

- Enhanced Visibility: Beyond replacing Excel files, the tool provides more profound and more flexible insights into current performance and trends.
- Advanced Filtering: Managers can filter and view data by date ranges, packaging sites, product categories, and more.
- Comparative Analytics: Built-in functionality allows for quick comparisons of current versus previous data, and performance versus target values.
- No Manual Double-Checking: Unlike Excel reports, the tool ensures data reliability and consistency—eliminating the need for manual double-checking of values.
- Pre-Formatted Visuals: Cell colour formatting is already applied within the sheet, clearly indicating performance status relative to targets.
- On-Demand Information Access: During monthly meetings with top management, any additional data beyond the pre-prepared reports can be retrieved instantly, supporting agile decision-making.

Other company users also benefit significantly from the Global KPI application, as it provides centralised access to a wide range of KPIs organised by packaging site and country. By consolidating performance data into a single interface, the application streamlines their workflow and eliminates the need to navigate multiple separate apps when analysing KPIs. Additionally, top management can conveniently access real-time data between scheduled monthly meetings, allowing them to monitor developments and respond more quickly to changes in the company's performance.

The Analytics team gained valuable hands-on experience throughout the development of the application. While the creation process was time-intensive, the resulting tool has significantly streamlined their workflow, boosted overall efficiency and saved substantial time. This improved efficiency is especially evident in the reduced effort required to prepare two large monthly reports, as well as in the accelerated execution of other related tasks.

The usage data from the Global KPI application confirms that the majority of reporting activities are completed within the first two weeks of each month. As illustrated in figure 14, the application's usage in December 2024 reflects this trend, highlighting a concentrated period of activity during the early part of the month.

Figure 14: Sessions in December 2024
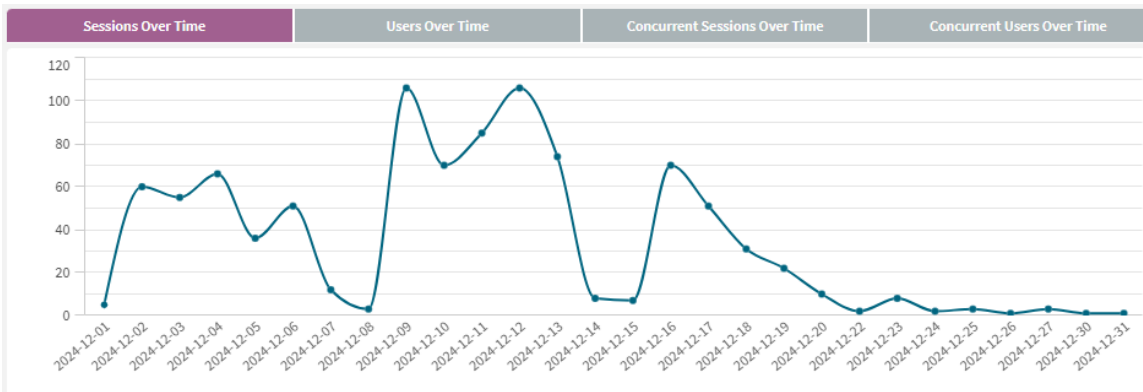
Source: Adapted from Qlik Sense (2024).

6.4 Adoption of the application by company

6.4.1 Process of adoption by end users

Following the successful launch of the Global KPI application, the development team focused on encouraging users to integrate it into their daily routines. The goal was for team members to rely on the app when preparing leadership presentations and coordinating the exchange of two major monthly reports. Top management, in turn, could use the application to monitor business performance between scheduled meetings. Meanwhile, employees across departments were encouraged to utilize the tool to support their own tasks, reinforcing the application's role as a central resource for performance tracking and decision-making.

The Analytics team was already acquainted with the development process and gained familiarity with the application's features, its data structure, accuracy, and visual representation. Their prior experience using Qlik Sense for report creation further strengthened their understanding of the platform's functionality, enabling them to effectively support the development and ensure data integrity throughout the project.

The introduction of application that consolidate multiple KPIs into a single interface significantly simplified the data-gathering process. While certain KPIs—such as the TPT, which is measured at the regional level and not included in the Global KPI application—still required manual collection from separate sources, the overall preparation of reports became more efficient. For the Analytics team, the most impactful benefit was the application's ability to facilitate the exchange of two major monthly reports.

Transitioning to the new application caused minor challenges during the first month after its release, primarily as users familiarized themselves with navigating the interface to locate the necessary data. However, according to one team member, adapting to a tool that simplifies work was not difficult. Team members noted that while they continued using existing applications to retrieve specific KPIs, they turned to the Global KPI application when a broader, more comprehensive view was needed.

The Analytics team manager was closely involved in every stage of the application's development and expressed satisfaction with the outcome. Although she was not directly responsible for preparing reports, she regularly used the Global KPI application to monitor KPIs. Over time, she became accustomed to tracking business metrics through the application.

The adoption process of the Global KPI application varied among managers. The Global Supply Chain Manager, already well-versed in Qlik Sense applications, frequently used them to monitor performance metrics beyond the standard reporting cycle. Thanks to his familiarity with the platform's functionality, he transitioned smoothly to the new tool.

The adoption process differed for the manager overseeing two platforms, who had previously received monthly KPI reports prepared for each site. Unlike others, he was unfamiliar with Qlik Sense applications and initially found the idea of accessing all data through a single application appealing. However, he was hesitant about having to retrieve the data himself, which would require learning how to navigate the application.

Following the application's presentation, he arranged a meeting with the Analytics Team Manager to express his concerns. While the analytics manager emphasized the importance of using the Global KPI application, she proposed a practical solution: the platform manager could delegate the reporting task to a member of his team. She argued that the reporting process had been simplified to the greatest extent possible, making it feasible for his employees to handle it independently. After internal consultation, the proposed solution was accepted.

The manager responsible for the KPI per Countries report did not have similar complaints and accepted the use of the prepared application. He found the dynamic insights provided by the Global KPI application particularly valuable, allowing him to stay informed with up-to-date data. For monthly meetings, he simply captured screenshots of the relevant dashboards.

During the preparation phase, other company employees were not considered the primary target users of the Global KPI application. However, due to the application's broad functionality, the development team anticipated that additional users could benefit from its features. Adoption among these employees varied based on their specific needs. Those who regularly required access to multiple KPIs for analytical purposes were more inclined to embrace the application. For others, motivation to adopt the tool was largely influenced by their team managers, who actively demonstrated how the application could simplify daily tasks and improve efficiency.

6.4.2   Top management support as a part of adoption of the app

The adoption of the new application varied among members of top and upper management, but their most significant contribution lay in encouraging others to embrace its use. Some leaders were already familiar with Qlik Sense and regularly used it to access performance data, which made their transition to the Global KPI application seamless. Others, who typically relied on prepared reports rather than direct interaction with analytics tools, still played a key role by promoting the application's benefits, particularly its ability to simplify the report preparation process. Their endorsement helped drive broader acceptance across teams and departments.

The Supply Chain Manager, a regular user of the Global KPI application, actively promoted its usability during a meeting with the Heads of Platforms, Heads of Countries, and other local managers. Given the company's positive experience with Qlik Sense—known for its effectiveness in task completion—he advocated for extending this good practice by adopting the newly developed application more broadly. Recognizing that some employees were already familiar with Qlik Sense, he aimed to motivate them to transition to the Global KPI tool. He emphasized that digital solutions exist to simplify work and should be utilized to their fullest potential. As a result, all department heads were tasked with reviewing the Global KPI application (if not already using it) to assess how it could support their operations.

The Analytics Team Manager played a pivotal role in promoting the adoption of the Global KPI application. With a clear understanding of its functionality and the benefits it offered to various stakeholders, she actively championed its use across the organization. Her team was already motivated to engage with the application, having been directly or indirectly involved in its development. She extended her influence on other teams she collaborated with, identifying where the application could add value. During meetings with department heads, she consistently highlighted the application's key features and demonstrated its practical use by referencing examples extracted directly from the tool. In addressing differing expectations with the Head of two platforms—who preferred receiving reports in Excel format—she proposed a solution that member of his team could use the application and

deliver data in Excel form to him. That not only resolved the conflict but also contributed to broader adoption of the application.

Another example of upper management promoting the use of the Global KPI application was the Head of Countries, who proactively invited all his employees to attend the application's initial presentation. After recognizing the practical benefits it could offer in daily operations, he promptly implemented its use within his team. This leadership-driven approach helped foster early adoption and demonstrated the application's value in streamlining tasks. Similar scenarios unfolded across other departments, where local managers followed suit by encouraging their teams to integrate the application into their workflows.

6.5   Feedback and summary of application's benefit to the company

To collect feedback on the Global KPI application, I conducted a survey. A survey is a list of questions designed to gather a set of desired data or opinions from a specific group of people. Surveys can be administered quickly and allow data collection from a large number of participants, making them a flexible and powerful tool for evaluating diverse research areas (Sharma et al., 2021).

I distributed a survey to the Analytics department on global, regional and local levels (25 employees), featuring both quantitative and qualitative questions, along with an open-ended response option. The quantitative portion used a 5-point Likert scale, where 1 represented "Not at all" and 5 signified "Extremely agree." All responses were automatically saved in a centralized database. After the Analytics team completed the survey, I conducted a comprehensive analysis to assess user sentiment and identify areas for improvement.

The initial step in the analysis involved validating the received responses to ensure reliability and accuracy. The criteria applied during this validation process included:

- Completeness of answers
- Internal consistency and honesty of responses
- Removal of any duplicate entries or potential spam
- Evidence of a clear understanding of the survey questions

To streamline the analysis of qualitative responses, each answer was coded numerically (e.g., 1 – Yes; 2 – No; 3 – Maybe). This conversion enabled easier aggregation and statistical processing. Where applicable - average and median were counted, the same as the frequency of answers.

The survey questions assessed user satisfaction with various aspects of the Global KPI application. Key focus areas included:

- Design and user interface: Evaluating the visual appeal and ease of navigation

- Functionality and features: Gauging the effectiveness of built-in tools
- Data accuracy: Ensuring the reliability of presented metrics
- Team responsiveness: Measuring support in resolving issues promptly
- Usefulness in daily work: Understanding the application's impact on workflow efficiency

The overarching goal was to determine whether the application delivered added value and made users' jobs easier.

Figure 15: Frequency of application's use
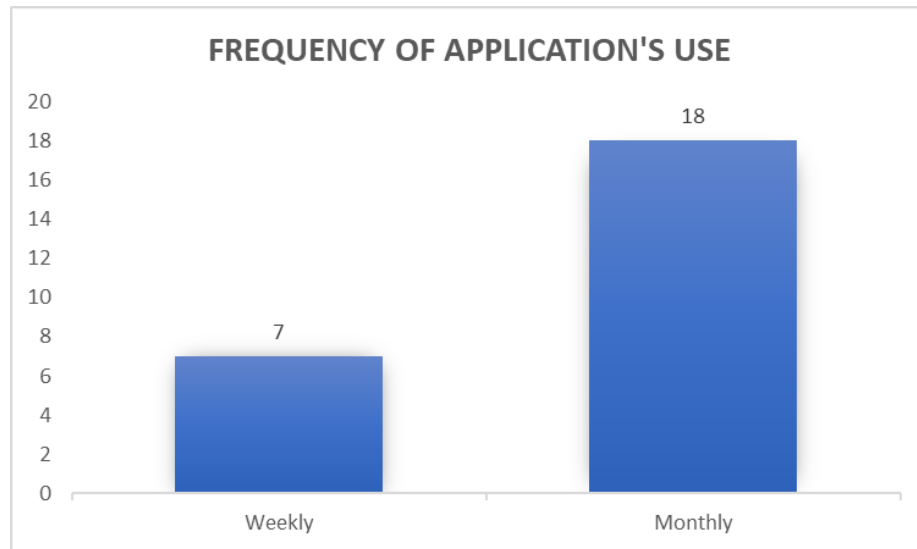
Source: Own work (2025).

All 25 respondents were asked about the frequency with which they use the Global KPI application. As shown in figure 15, the majority reported using the application monthly, while a smaller group indicated weekly usage. Upon closer examination of the responses, a notable pattern emerged: weekly usage was predominantly observed among members of the Global Analytics team—specifically, six individuals from that group—alongside one employee operating at the regional level.

To assess the user experience regarding the application's interface and navigation, respondents were asked to rate their level of agreement with the statement: "Navigation and finding the information in the Global KPI app is very easy."

$\rightarrow$ 64% of respondents expressed their extreme agreement (5)
$\rightarrow$ 36% responded with "agree" (4).

This calculates to an average of 4.6 on a 1-5 scale, which indicates that the design of the application is simple to use for different users.

Additionally, users were asked to evaluate their satisfaction with the visual presentation of data elements, such as charts and graphs. All respondents rated their satisfaction with either

a 4 or a 5, again producing an average of 4.6. These results suggest that the design and data visualisation components of the application have been executed effectively, supporting ease of interpretation and engagement.

To better understand which features users found most valuable, survey respondents were asked to select their favourite or most useful feature offered by the Global KPI application. They could choose from five predefined options or submit their own input via an open-ended field. As illustrated in figure 16, the highest-rated feature was the integration of data from multiple sources, highlighted as most useful by the largest share of respondents. Close behind was the self-service capability, cited by seven participants as their top choice.

*Figure 16: Raking of useful application features*
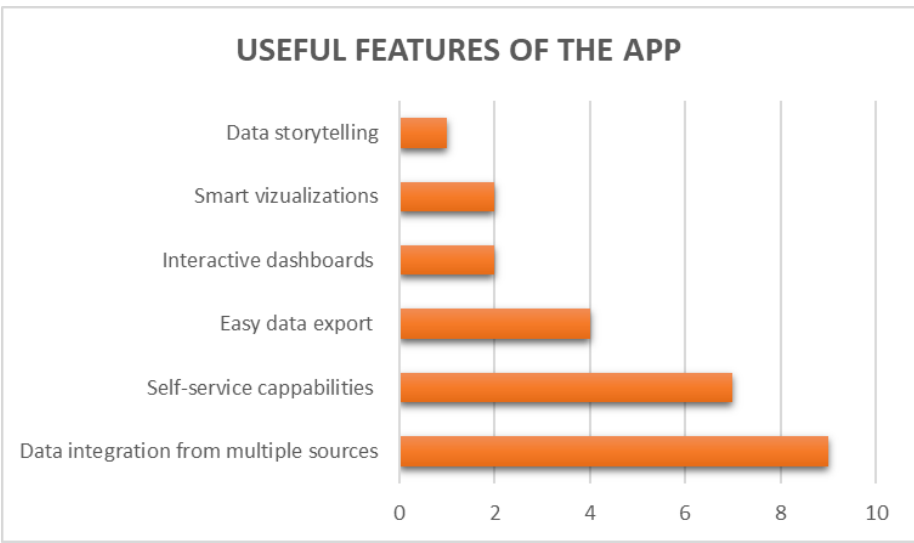
Source: Own work (2025).

Additional features included easy data export, selected by four users; interactive dashboards and smart visualisations, each favoured by two respondents; and data storytelling, noted as most useful by one individual.

Most Global Analytics team members favoured data integration as their preferred feature. This suggests that, at the global level, these users frequently work with diverse datasets, and having a unified platform significantly enhances their efficiency. The remaining responses were dispersed across employees at global, regional, and local levels without any notable clustering, indicating broader functional preferences based on individual roles or contexts.

One of the core objectives of the Global KPI application is to provide users with a centralised platform for tracking and monitoring multiple KPIs. The feedback (figure 17) was overwhelmingly positive—24 out of 25 participants rated the application with either a 5 or 4 on the scale, indicating a high level of effectiveness and user satisfaction.

Figure 17: Improved process of tracking KPIs
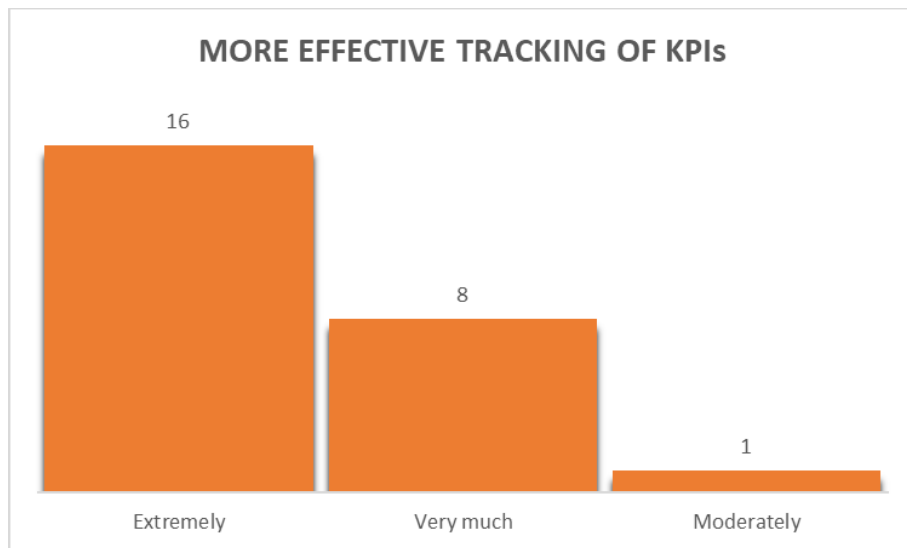
Source: Own work (2025).

Building on the previous question, respondents were asked whether using the Global KPI application had enhanced their productivity. As illustrated in figure 18, 92% of participants rated their experience with a 4 or 5, indicating strong agreement that the application supports efficient work. This high level of positive feedback suggests that the tool has had a significant impact in helping users complete KPI-related tasks more quickly and effectively.

Figure 18: Enhanced productivity while using the application
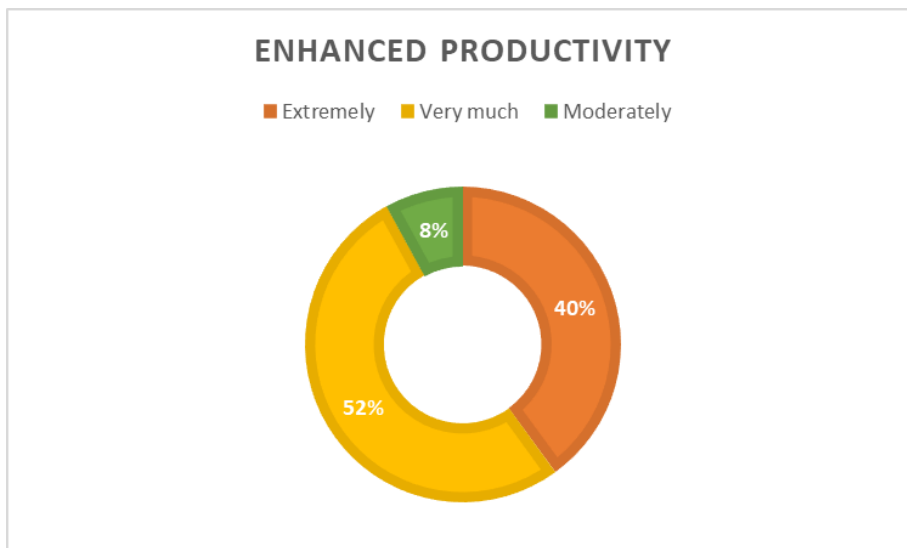
Source: Own work (2025).

Data accuracy and reliability are essential components of any performance monitoring tool, and the survey results affirm that the Global KPI application meets these expectations:

→ 88% of respondents who answered with 5 and

→ 12% who answered with 4.

Reliable performance is critical for any workplace application, and the Global KPI tool meets this expectation exceptionally well. Out of 25 respondents, 24 reported encountering no technical issues or glitches during their usage. Furthermore, none of the participants indicated experiencing lag time or slow performance that negatively impacted their work.

Communication with the team that created the application was measured through questions: "How helpful and responsive is the support team in resolving any issues related to the Global KPI App?" and "How responsive is the support team in accepting and applying suggested changes to the application?". To both questions, respondents answered with 4 or 5, suggesting that communication with the team is easy, the team is responsive and open to suggestions (figure 19).

Figure 19: Responsiveness of the support team
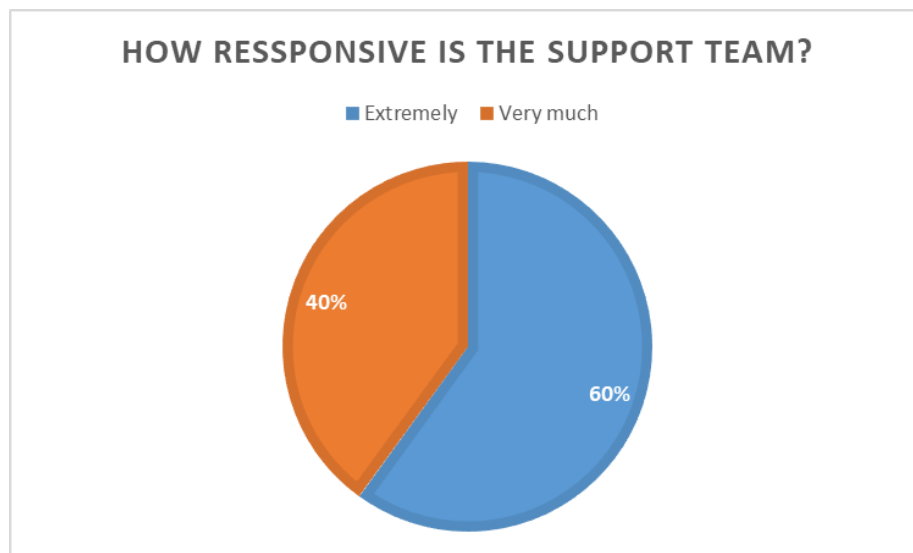
Source: Own work (2025).

To gather ideas for future enhancements, respondents were asked to suggest improvements to the features or functionalities of the Global KPI application. Eight participants provided constructive feedback aimed at further simplifying their workflows. Among the most common proposals were:

- Adding sheet for custom tables tailored to specific analytical needs
- Including a dedicated sheet with TPT data, which is currently tracked in a separate regional-level application
- Introducing a sheet that incorporates dimensions used by local-level teams for more granular analysis
- Enhancing further filtering options to allow for more flexible data slicing

Respondents were asked to compare the use of this application to other applications in the company (if they used them – figure 20).

→ 20% of them graded this application as much better than other applications,
→ 56% of them as slightly better than other applications and
→ 24% as about the same as other applications.

Figure 20: Global KPI app compared to other company app
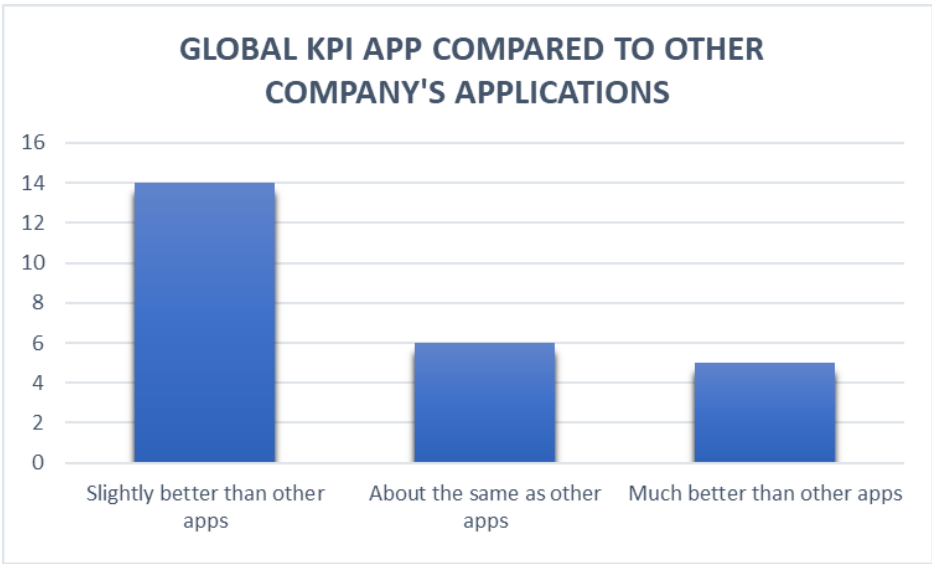
Source: Own work (2025).

When asked if they would recommend this application to a coworker, all of them answered "yes".

The overall user experience with the Global KPI application was rated highly across the board. Respondents graded their satisfaction with a median score of 5 and an average of 4.48 on a 5-point scale, which are strong indicators of success, particularly for a newly launched tool.

Based on the collected responses, it is evident that the Global KPI application has delivered meaningful benefits to the company. Its implementation has led to improved business processes by enabling employees to complete their tasks more efficiently and with less time investment. This boost in productivity underscores the practical value of the application in supporting day-to-day operations.

Furthermore, the reliability of the data provided within the application has contributed positively to the decision-making process, reinforcing trust in the platform. The addition of the Global KPI tool has strengthened analytic capabilities across global, regional, and local levels.

Overall, user sentiment toward the application is strongly positive, with high satisfaction levels reported regarding its features, performance, and design. Notably, users also provided thoughtful suggestions for improvement, signalling their engagement and willingness to contribute to the tool's evolution. Moving forward, it would be prudent to carefully consider these recommendations, as they offer valuable guidance for tailoring the application more closely to users' needs and ensuring its continued relevance and success.

7   ANALYSIS AND DISCUSSION

The development of the Global KPI application brought several meaningful improvements:

Operational improvements

One of the most significant changes was the reduction in time required to gather and analyse KPIs and prepare reports. Previously, data had to be manually collected from multiple sources, which was both time-consuming and prone to errors. With the new application, users can now access up-to-date KPIs directly from a centralised platform, streamlining the reporting process and enhancing overall productivity.

By consolidating data from various sources into a unified system, the application also minimised the risk of discrepancies caused by manual data transfers. The reliability and accuracy of the data improved, enabling stakeholders to interpret trends better and make informed decisions. The ability to compare data over time within the application further supports strategic planning and performance evaluation.

Another key benefit is the increased accessibility of data. Employees and managers can retrieve the information they need independently, without relying on intermediaries. This autonomy enables more proactive monitoring of KPIs, allowing users to identify trends early and anticipate potential deviations.

Finally, the application's flexible architecture ensures scalability. New KPIs can be added easily as business needs evolve, making the platform adaptable for future growth and continuous improvement.

Technological and process-oriented change

Since few digital applications had been previously implemented at the global level within the supply chain, the development of this application marked a significant step toward digitalization of the process. It fundamentally transformed how data was accessed and delivered. As a result, employees were able to shift their focus from manual data collection to data analysis, adding more strategic value to their roles. Managers also gained the ability to interact directly with data through the application, enhancing their decision-making capabilities.

While some stakeholders initially showed resistance to adopting the new platform, it ultimately served as a valuable opportunity for them to become familiar with this type of technology. By designing the application for a diverse group of users, the organisation not only improved current operations but also laid the groundwork for future digital projects of similar scale and purpose.

Lessons learned

One of the key lessons learned during the development of the Global KPI application was the critical importance of thoroughly understanding the business context behind each KPI. Without this foundational knowledge, the development process would have been significantly more difficult. While the team occasionally lacked technical expertise in certain phases, these gaps were successfully bridged through collaboration with experienced colleagues who provided valuable support.

An iterative approach was adopted throughout the project. The initial version of the application was not perfect, but it served as a functional starting point. Continuous feedback from users played a vital role in refining and improving the application, making this adaptive method particularly well-suited for the project's needs.

The most time-consuming aspect of development was data integration. Preparing, cleaning, and aligning data from various sources required substantial effort and coordination, often with assistance from other teams to overcome technical challenges.

Although the application was designed to be user-friendly, some users still required guidance. In these cases, open and responsive communication with the development team was essential. Their availability and willingness to support users ensured a smoother adoption process and reinforced trust in the solution.

8 CONCLUSION

This thesis presents the development of a Qlik Sense application designed to replace two major Excel reports that were previously prepared manually each month. The application was also designed to provide a dynamic platform for data retrieval and visualisation. Its primary goal was to establish a centralised and automated solution for tracking KPIs, thereby enhancing reporting efficiency, improving data accuracy, and offering deeper operational insights.

To propose a suitable solution, it was necessary to gain a clear understanding of the company's internal processes—particularly within the supply chain. The focus was placed on the global Analytics team, and interviews were conducted with three of its members. Their insights revealed a clear need for increased automation in reporting activities.

The implementation of the Global KPI application was carried out over seven months. The development process involved multiple phases and challenges, which the project team successfully addressed. Upon completion, the application was published and made available to the broader supply chain. Overall, the adoption process went smoothly, although a few cases of resistance were observed. These were resolved through compromise and collaboration.

The development of this application had a significant impact on supply chain processes, particularly within the Analytics team. Report preparation became notably more efficient, reducing the time and effort required and thereby enhancing overall productivity. By consolidating data from multiple sources into a unified platform, the application helped minimise the risk of discrepancies commonly caused by manual data transfers. Furthermore, the initiative familiarised users with dynamic platforms such as Qlik Sense, marking a key step toward the digitalization of supply chain processes.

This thesis bridges knowledge of data analytics tools with their practical implementation in a corporate supply chain context. The project highlights how tools like Qlik Sense can directly support operational excellence and reduce administrative burden by transforming the way data is managed and utilised.

While this thesis successfully demonstrates the development and implementation of a Global KPI application using Qlik Sense, several limitations must be acknowledged. Feedback was primarily gathered from analytics stakeholders, which may not represent the full spectrum of end-users. Additionally, the evaluation was based on initial rollout stages, leaving long-term performance and impact unexamined. Although the application was improved based on user opinions and experiences, there wasn't a formal usability testing process in place to objectively evaluate how easy and effective the application is to use.

To enhance the effectiveness and scalability of the Global KPI application, several opportunities for improvement can be considered.

- Conducting structured usability testing across a broader group of end-users would provide more objective insights into application performance and user experience.
- The range of KPIs tracked by the application could be extended. Currently, the focus is on KPIs used in two major Excel-based reports. Expanding this scope would not only streamline reporting processes but also offer a more comprehensive view of overall business performance.
- Qlik Sense's capability for automated data loading presents another opportunity for improvement. Automating the weekly data refreshes through scheduled reloads would significantly enhance efficiency, allowing the development team to allocate time to higher-value tasks.
- Finally, to support broader adoption, the existing PowerPoint presentation used to introduce the application could be replaced with a short video tutorial or a concise user

guide in Word or PDF format. These formats would likely be more engaging and accessible, helping users better understand the application's capabilities and encouraging more frequent use.

Overall, these improvements would help increase the application's value, usability, and strategic impact, potentially spreading its use beyond supply chain departments.

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APPENDICES

Appendix 1: Summary in Slovene language – Povzetek v slovenskem jeziku

Management dobavne verige (SCM) je opredeljen kot niz nalog, potrebnih za načrtovanje, upravljanje in izvajanje pretoka blaga od dobavitelja do končnega potrošnika na najbolj učinkovit način (Kumar et al., 2024, str. 3). Digitalizacija v SCM-ju ima vse večji strateški pomen za podjetja, saj vpliva na ustaljene paradigme, poslovne modele in meje industrij. Digitalizacija SCM-ja lahko vodi do razvoja novih in dragocenih virov, ki lahko zagotovijo trajno konkurenčno prednost (Herold et al., 2021). Številne raziskave kažejo na pomen podatkov v upravljanju SCM-jem. Carmignani (2009) izpostavlja štiri ključne procese SCM-ja – analizo zahtev kupcev, upravljanje informacij, upravljanje zalog ter upravljanje sredstev in transporta – pri čemer slednje tri pogosto najbolj vplivajo na uspešnost verige.

V farmacevtski industriji je SCM še posebej kompleksen zaradi kratkih življenjskih ciklov izdelkov, globalizacije in regulativnih zahtev (Singh et al., 2016). Zato Gruchman et al. (2023) poudarjajo nujnost digitalizacije in uporabe podatkovnih orodij, ki izboljšujejo preglednost, natančnost in uspešnost procesov. Namen magistrske naloge je prav v tem: analizirati merjenje ključnih kazalnikov uspešnosti (KPI) v SCM-ju velike farmacevtske družbe ter pokazati, kako lahko podatkovna orodja zmanjšajo ročno delo, povečajo natančnost podatkov in optimizirajo celotno oskrbovalno verigo.

Ta magistrska naloga raziskuje dinamiko SCM-ja v farmacevtski industriji z analizo dejanskih praks v veliki mednarodni družbi. Glavni cilj je analizirati proces merjenja KPI-jev v oskrbovalni verigi podjetja, oceniti trenutno učinkovitost, preveriti pripravljenost organizacije na digitalno preobrazbo ter predlagati izboljšave. Osnovni namen naloge je pokazati kako lahko poenostaviti dolgotrajne ročne postopke poročanja z uporabo podatkovnih orodij.

Imela sem priložnost pridobiti vpogled v procese znotrjan analitične ekipe, ki ima ključno vlogo pri zagotavljanju vpogledov v uspešnost za višje in srednje vodstvo. Med številnimi nalogami je bila najpomembnejša meritev KPI-jev. Za spremljanje KPI-jev je ekipa uporabljala aplikacije Qlik Sense, pri čemer je bila vsaka razvita za en sam kazalnik uspešnosti. Pri pripravi poročil za vodstvo je bilo opaziti, da se večina poročanja izvaja z osnovnimi Excelovimi preglednicami, medtem ko se je Qlik Sense uporabljal predvsem za poročila, osredotočena na posamezne KPI-je.

Ena izmed večjih težav je bila mesečna priprava dveh ključnih poročil—KPI-ji po državah in KPI-ji po proizvodnih obratih. Ta poročila so vključevala širok nabor kazalnikov, njihova priprava pa je zahtevala pridobivanje podatkov iz več virov za vsak KPI, kar je bil dolgotrajen in zahteven proces.

Nova aplikacija Global KPI je bila razvita kot rešitev za ta izziv. Združuje več KPI-jev v eno nadzorno ploščo Qlik Sense, kar odpravlja potrebo po ročnem poročanju. S

poenostavitvijo zbiranja in prikaza podatkov aplikacija omogoča učinkovitejše spremljanje uspešnosti na ravni držav in lokacij, kar je bistveno za upravljanje farmacevtske dobavne verige.

Razvoj aplikacije se je začel z določitvijo jasnih smernic, vključno z izborom KPI-jev. Integracija KPI-jev v aplikacijo je potekala po prilagojenem postopku za vsak kazalnik. KPI-ji, ki so bili že spremljani v obstoječih aplikacijah Qlik Sense, so bili vključeni bolj enostavno, medtem ko je vključevanje novih KPI-jev predstavljalo večje izzive. Uporabljena so bila orodja, kot je Alteryx, za identifikacijo in obdelavo ustreznih virov podatkov. Velik del razvoja je bil namenjen čiščenju, razvrščanju, filtriranju in preverjanju podatkov, kar je bilo ključno za zanesljive rezultate.

Pri oblikovanju aplikacije so razvijalci zasnovali prikaz po vzoru izvirnih Excelovih poročil, kar je omogočilo uporabnikom lažjo prilagoditev. Dodane so bile dodatne strani za podporo uporabnikom iz različnih oddelkov, s čimer se je uporabnost orodja razširila izven analitične ekipe. Dinamične funkcije Qlik Sense—kot so prilagodljive tabele, filtri, interaktivni grafikoni in podatkovni vsebniki—so bile skrbno implementirane za izboljšanje uporabniške izkušnje.

Po predstavitvi je bila aplikacija uspešno objavljena in uvedena. Sprejem med uporabniki je bil različen. Globalna analitična ekipa jo je sprejela brez večjih zadržkov. Sprva je bil vodja platforme zadržan pri samostojnem pridobivanju podatkov, vendar je bila zanj pripravljena prilagojena rešitev. Zaposleni na regionalni in lokalni ravni so orodje hitro sprejeli in ga vključili v svoje poslovne procese, kjer je prinašalo dodano vrednost.

Za boljši vpogled v vtise uporabnikov o aplikaciji Global KPI sem izvedla anketo med zaposlenimi v analitičnem oddelku na globalni, regionalni in lokalni ravni. Udeleženci so odgovarjali na vprašanja, ki so ocenjevala funkcionalnost in uporabniško izkušnjo aplikacije.

Povratne informacije so razkrile več skupnih tem. Uporabniki so aplikacijo ocenili kot vizualno privlačno in enostavno za uporabo, kar je prispevalo k pozitivnemu prvemu vtisu. Cenili so širok nabor funkcij, zlasti možnost spremljanja več KPI-jev na eni platformi. Ta konsolidacija podatkov je bistveno izboljšala učinkovitost njihovega dela in povečala produktivnost.

Uporabniki so izrazili tudi zaupanje v zanesljivost podatkov, ki so jim pomagali pri sprejemanju odločitev. S tehničnega vidika je bila aplikacija pohvaljena zaradi stabilnosti in odsotnosti večjih napak. Poleg tega so izpostavili dostopnost razvojne ekipe, ki je bila vedno pripravljena pomagati. Na splošno so rezultati ankete pokazali visoko stopnjo zadovoljstva z aplikacijo, tako glede zmogljivosti kot uporabniške izkušnje.

Ta magistrska naloga ponuja široke vpoglede v praktične in strateške vidike digitalne preobrazbe, zlasti na področju analitike dobavne verige. Ključna lekcija je, da uspešna

inovacija zahteva več kot tehnične nadgradnje—uspeva, ko so rešitve zasnovane glede na dejanske potrebe uporabnikov in obstoječe delovne tokove. Z oblikovanjem nadzorne plošče Qlik Sense po vzoru Excelovih poročil in zgodnjim vključevanjem deležnikov je projekt omogočil gladko uvedbo in zmanjšal odpor. Pomemben poudarek je tudi na kakovosti podatkov; velik del razvoja je bil namenjen čiščenju in preverjanju podatkov, kar je bilo nujno za zanesljivost. Poleg tega se je nadzorna plošča izkazala kot več kot le poročevalno orodje—postala je strateško sredstvo, ki je omogočilo boljše odločanje z dostopnimi in uporabnimi podatki. Povratne informacije uporabnikov so potrdile uporabnost, stabilnost in vpliv orodja, kar kaže, kako lahko dejanske izkušnje vodijo k nadaljnjim izboljšavam. Na splošno ta naloga predstavlja načrt, kako lahko premišljen razvoj aplikacij—ki temelji na uporabniški izkušnji, podatkovni integriteti in usklajenosti organizacije—prinese pomembne in trajne spremembe.

Appendix 2: In-depth and semi-structured interview questions

- Interview with a long-term employee

Introduction:

I'm conducting this interview to understand the state of the Analytics team before the introduction of the Global KPI app—specifically in terms of how the team was using the existing Qlik Sense applications. I'm interested in learning more about the workflows and processes that were in place at the time, how they were carried out, and where you believe there was potential for improvement.

This interview will last approximately two hours, with a short break after the first hour. We'll be speaking in Serbian, and I'd like to record our conversation. With your written consent, I'll transcribe the recording afterwards and share the transcription with you in case you'd like to review or make any changes.

The information gathered in this interview will help me better understand the dynamics within the team before the introduction of the Global KPI app and will serve as a basis for my master's thesis. To maintain anonymity, no personal names will be mentioned—only your professional title (Supply Chain Manager) will be referenced.

Questions:

1. Could you give me a quick overview of your role in the Analytics team? What are your main responsibilities day by day?
2. When you're preparing reports or presentations, which tools do you rely on most? Do you usually combine multiple tools? How comfortable are you with each of them? If possible, could you walk me through a recent report or presentation you worked on—from data collection to the final output?
3. Do you remember when the team first started using Qlik Sense? What was the first application about, and how did the idea of using Qlik Sense come up—was it driven by management? Who built it, and how did the team adapt to this new way of presenting data? How many Qlik Sense apps are currently in use, and are they all being actively used?
4. If you use Qlik Sense for reporting, could you show me how that process works—from accessing the app to generating the final report?
5. How useful do you find Qlik Sense in your work? What features do you like most, and are there any limitations you've noticed? Would you personally like to see more Qlik Sense apps developed for the team?
6. Do you manage any Qlik Sense applications yourself? If so, could you explain what that involves, like how often the data gets updated and what kind of maintenance is required? Where does your data typically come from, and how do you ensure it's accurate and reliable?

7. If you've built a Qlik Sense app yourself, was the process challenging? Could you walk me through the process? Do users often request changes—like adding filters or new visualisations—and does someone need to approve those changes before the app is republished?

8. Who are your reports usually prepared for? If it's top management, how do they communicate their needs? Is it challenging to deliver what they ask for using the tools available? Does it take a long time to prepare, and do you feel the final output meets their expectations? If you have an example of a request and how you handled it, that would be great.

9. How are tasks divided within the team? Is everyone responsible for tracking and publishing certain KPIs? Are there deadlines for when KPIs need to be ready, and what happens if a key KPI is delayed but is still required for an important report?

10. Which data tools are most used in your team? Would you say the reporting process is mostly manual, automated, or a mix of both? What could be improved? Also, how many team members manage Qlik Sense apps versus those who just use them?

11. Are there any data tools you'd like to see introduced or used more often in the team? Maybe something new, or an existing tool that's underutilized?

12. Could having a Qlik Sense app that combines more KPIs speed up the reporting process? Would it be possible for management to use the app directly in some cases, so you wouldn't need to prepare separate reports or presentations? If you have an example of an app that's already widely used by management, could you show me how it works?

13. How would you describe communication within the team and with management? When deadlines are tight, does it get stressful? Does pressure highlight the need for more automation or smarter tools to ease the workload?

14. Which KPIs are most frequently tracked and requested? Are there Qlik Sense apps that effectively support those KPIs? If yes, does that make reporting easier? If not, why do you think that is? What tools do you use to track them, and how would you improve that process?

15. Do you have any comments regarding the data tools used, the atmosphere in the team, or anything else that you think would be important to point out?

Next step in the process is preparing a transcript from the interview, that will be sent to you to confirm it. After that I will analyse it and use it in my master thesis.

Thank you for participating, being open to all the questions and showing the examples.

- Semi- structured interviews with two other employees

Introduction: I'm conducting this interview to understand the state of the Analytics team before the introduction of the Global KPI app—specifically in terms of how the team was using the existing Qlik Sense applications. I'm interested in learning more about the

workflows and processes that were in place at the time, how they were carried out, and where you believe there was potential for improvement.

This interview will last 30-50 minutes. We'll be speaking in English, and I'd like to record our conversation. With your written consent, I'll transcribe the recording afterwards and share the transcription with you in case you'd like to review or make any changes.

The information gathered in this interview will help me better understand the dynamics within the team before the introduction of the Global KPI app and will serve as a basis for my master's thesis. To maintain anonymity, no personal names will be mentioned—only your professional title (Senior Manager/Supply Chain Performance Manager) will be referenced.

Questions:

1. Could you give me a quick overview of your role in the Analytics team? What are your main responsibilities day by day?
2. When you're preparing reports or presentations, which tools do you rely on most? Do you usually combine multiple tools? How comfortable are you with each of them?
3. Do you remember when the team first started using Qlik Sense? What was the first application? Who built it, and how did the team adapt to this new way of presenting data? How many Qlik Sense apps are currently in use, and are they all being actively used?
4. How useful do you find Qlik Sense in your work? What features do you like most, and are there any limitations you've noticed? Would you personally like to see more Qlik Sense apps developed for the team?
5. Do you manage any Qlik Sense applications yourself? If so, could you explain what that involves, like how often the data gets updated and what kind of maintenance is required?
6. Where does your data typically come from, and how do you ensure it's accurate and reliable? If you've built a Qlik Sense app yourself, was that a challenging process? Could you walk me through how it was done? Do users often request changes—like adding filters or new visualizations—and does someone need to approve those changes before the app is republished?
7. Who are your reports usually prepared for? If it's top management, how do they communicate their needs? Is it challenging to deliver what they ask for using the tools available? Does it take a long time to prepare, and do you feel the final output meets their expectations?
8. How are tasks divided within the team? Is everyone responsible for tracking and publishing certain KPIs? Are there deadlines for when KPIs need to be ready, and what happens if a key KPI is delayed but is still required for an important report?
9. Which data tools are most commonly used in your team? Would you say the reporting process is mostly manual, automated, or a mix of both? What do you think could be

improved? Also, how many team members manage Qlik Sense apps versus those who just use them?

10. Are there any data tools you'd like to see introduced or used more often in the team? Maybe something new, or an existing tool that's underutilized?

11. Could having a Qlik Sense app that combines more KPIs speed up the reporting process? Would it be possible for management to use the app directly in some cases, so you wouldn't need to prepare separate reports or presentations?

12. How would you describe communication within the team and with management? When deadlines are tight, does it get stressful? Does pressure highlight the need for more automation or smarter tools to ease the workload?

13. Which KPIs are most frequently tracked and requested? Are there Qlik Sense apps that effectively support those KPIs? If yes, does that make reporting easier? If not, why do you think that is? What tools do you use to track them, and how would you improve that process?

14. Do you have any comments regarding the data tools used, the atmosphere in the team, or anything else that you think would be important to point out?

Next step in the process is preparing a transcript from the interview, that will be sent to you to confirm it. After that I will analyse it and use it in my master thesis.

Thank you for participating, being open for all the questions and showing the examples.

Appendix 3: Survey questions

I'm conducting this survey to gather feedback on the newly developed Global KPI Application. The main goal is to understand whether the application is user-friendly, practical, and whether it helps reduce the time spent on daily tasks.

The responses you provide will be gathered and analysed as part of my master's thesis. Your honest feedback is greatly appreciated, as it plays a vital role in validating the benefits that the Global KPI Application has brought to the team.

Questions:

- The overall user experience of the Global KPI app is:

1. Very poor
2. Fair
3. Good
4. Very good
5. Excellent

- Navigation and finding the information in the Global KPI app is very easy.

1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

- To what extent has the Global KPI app helped you track and monitor your KPIs effectively?

1. Not at all
2. Slightly
3. Moderately
4. Very much
5. Extremely

- How satisfied are you with the visual presentation (charts, graphs, etc.) of data in the Global KPI app?

1. Not at all
2. Slightly
3. Moderately
4. Very much
5. Extremely

- Has using the Global KPI app enhanced your productivity?

1. Not at all
2. Slightly
3. Moderately
4. Very much
5. Extremely
6. Not applicable
7. *Place for an open answer*

- Have you encountered any technical issues or glitches while using the Global KPI app?

→ Yes
→ No
→ I am not sure
→ *Place for an open answer IF YES*

- How helpful and responsive is the support team in resolving any issues related to the Global KPI App?

1. Not at all
2. Slightly
3. Moderately
4. Very much
5. Extremely

- How responsive is the support team in accepting and applying suggested changes to the application?

1. Not at all
2. Slightly
3. Moderately
4. Very much
5. Extremely

- Have you experienced any lag time or slow performance with the Global KPI app that impacted your work negatively?

→ Yes
→ No
→ I am not sure
→ *Place for an open answer IF YES*

- Is the data provided by the Global KPI app accurate and reliable for taking business decisions?

1. Not at all
2. Slightly
3. Moderately
4. Very much
5. Extremely
6. Not applicable

- How regularly do you use the Global KPI app for your business operations?

1. Never
2. Rarely
3. Monthly
4. Weekly
5. Daily

- Is there a specific feature in the Global KPI app you find the most useful?

→ Data integration from multiple sources
→ Interactive dashboards
→ Easy data export
→ Self-service capabilities
→ *Other (please specify)*

- Which features or functionalities that you believe could be improved in the Global KPI app?

→ Name:
→ I am not sure

- Would you recommend the Global KPI app to other colleagues or employees within the company?

→ Yes
→ No
→ I am not sure

- How could we make the Global KPI app more useful and user-friendly for you?

→ No need for adjustments
→ *Place for the answer*
- Are you satisfied with the presentation and support provided to you for using the Global KPI App effectively?

1. Not at all
2. Slightly
3. Moderately
4. Very much
5. Extremely

- If you have used other Qlik Sense applications in the company for tracking KPIs before, how does this app compare?

1. Much worse than other apps
2. Slightly worse than other apps
3. About the same as other apps
4. Slightly better than other apps
5. Much better than other apps
6. I have not used other Qlik Sense applications for tracking KPIs.

- Please give me any other feedback that could be useful for either improving the Global KPI app or finishing my thesis. This is very important to me.
→ No
→ *Place for the answer*