UNIVERSITY OF LJUBLJANA

SCHOOL OF ECONOMICS AND BUSINESS

MASTER'S THESIS

TRANSFORMING NUMBERS INTO ACTIONS: USING DATA STORYTELLING FOR STRATEGIC DECISION MAKING AT SILIKO

Ljubljana, December 2025 KHALID OSMANOV

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ABSTRACT

The focus of this master's thesis is to present a practical solution aimed at resolving inefficiencies in data analysis and data utilization at Slovenian automotive supplier Siliko d.o.o. The plan is to achieve this goal by creating an automated sales dashboard using the business intelligence tool Microsoft Power BI. The objective is to replace time-consuming manual reporting with a tool that generates reports automatically in real-time, thereby enhancing data visibility and improving the strategic decision-making process. The thesis provides an overview of the automotive industry, business intelligence, and data storytelling, and implements the knowledge in a practical application of Siliko sales dashboard creation. The dashboard created presents a list of selected sales metrics, which are regularly monitored in sales review meetings together with the company's management and sales department. It uses different data storytelling techniques and appropriate visualizations to put emphasis on discrepancies, allowing for quicker insight derivation and decision-making. In the process of dashboard creation, video tutorials from YouTube were used to create a more visually appealing dashboard, while the artificial intelligence tool ChatGPT was used to correct coding mistakes and resolve problems with non-functionality. The thesis demonstrates the importance of data in the modern business environment and shows how Siliko can transform its sales data into strategic action by combining data storytelling with business intelligence. The dashboard presents a practical value for Siliko and should be expanded to other departments within the company.

Keywords: Business intelligence, Power BI, sales dashboard, data storytelling, strategic decision-making, key performance indicator (KPI)

SUSTAINABLE DEVELOPMENT GOALS

POVZETEK

Glavni namen te magistrske naloge je predstaviti praktično rešitev za odpravo neučinkovitosti pri analizi in uporabi podatkov pri slovenskem dobavitelju avtomobilske opreme Siliko d.o.o. V nalogi sem zasnoval in izvedel načrt izdelave avtomatizirane prodajne nadzorne plošče z uporabo orodja za poslovno analitiko Microsoft Power BI. Moj cilj je nadomestiti zamudno ročno pripravo poročil z orodjem, ki poročila ustvarja samodejno v realnem času, izboljšuje preglednost podatkov in podpira proces strateškega odločanja. V magistrski nalogi ponujam

vpogled v avtomobilsko industrijo, poslovno inteligenco in pripovedovanje podatkovnih zgodb, kar prikazujem skozi praktičen primer izdelave nadzorne plošče. Ta vključuje številne prodajne kazalnike, ki jih vodstvo podjetja in prodajni oddelek redno spremljajo na sestankih za pregled prodaje. Pri izdelavi nadzorne plošče sem uporabil različne tehnike pripovedovanja podatkovnih zgodb ter ustrezne grafične elemente, ki poudarjajo odstopanja in omogočajo hitrejše pridobivanje vpogledov ter učinkovitejše odločanje. Pri ustvarjanju nadzorne plošče sem uporabljal YouTube video vsebine z navodili za povečanje vizualne privlačnosti. Orodje za umetno inteligenco ChatGPT sem uporabil za odpravljanje napak v kodiranju in reševanje težav pri nedelovanju programa. V magistrskem delu poudarjam pomen podatkov v sodobnem poslovnem okolju ter prikazujem, kako lahko podjetje Siliko podatke s pomočjo povezovanja podatkovnih zgodb in poslovne inteligence pretvori v strateške ukrepe. Razvita nadzorna plošča ima za podjetje Siliko praktično vrednost, zato bi jo bilo smiselno razširiti tudi na druge oddelke znotraj podjetja.

Ključne besede: Poslovna inteligenca, Power BI, prodajniška nadzorna plošča, pripovedovanje podatkovnih zgodb, strateško odločanje, ključni kazalnik uspešnosti

CILJI TRAJNOSTNEGA RAZVOJA

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LIST OF ABBREVIATIONS

Sl. - Slovene

ACEA – (sl. Evropsko združenje avtomobilskih proizvajalcev); European Automobile Manufacturers Association

BCG – Boston Consulting Group

BI – (sl. Poslovna inteligenca); Business Intelligence

CRM – (sl. Upravljanje odnosov s strankami); Customer Relationship Management

DAX – Data Analysis Expression

EBIT – (sl. Dobitek pred obrestmi in davki); Earnings before interest and tax

ERP – (sl. Načrtovanje virov podjetja); Enterprise Resource Planning

EU – (sl. Evropska Unija); European Union

EV – (sl. Električno vozilo); Electric vehicle

GDP – (sl. Bruto domači proizvod); Gross domestic product

ICE – (sl. Motor na notranje izgorevanje); Internal combustion engine

KPI – (sl. Ključni kazalnik uspešnosti); Key performance indicator

MWh – (sl. Megavatna ura); Megawatt hour

OEM – (sl. Proizvajalec originalnih delov); Original equipment manufacturer

OLAP – (sl. Spletna analitična obdelava); Online analytical processing

RFID – (sl. Radiofrekvenčna identifikacija); Radio frequency identification

RFQ – (sl. Zahtevek za ponudbo); Request for quotation

VA – (sl. Vizualna analitika); Visual analytics

1 INTRODUCTION

In the modern corporate environment, where companies face global competitive pressures, Business Intelligence (hereinafter, BI) has become an important tool. It helps organizational leaders effectively collect and analyze data to make informed, data-driven decisions about their business operations. Despite many organizations already collecting data, its true value often remains underutilized and hidden in layered Excel sheets, invisible to key stakeholders. Research (Pfeffer & Sutton, 2000; Dykes, 2020) shows that data alone is not enough to facilitate any change in the organization. Only through a combination of business intelligence and appropriate storytelling techniques can data gathered by organizations deliver actual value, not just numbers.

The goal of this thesis is to help organizations remove data underutilization constraints, increase usage levels, and enhance data-driven decision-making in a corporate setting. The solution will be illustrated through an example of Siliko d.o.o., an automotive supplier from Slovenia, which faces the above-mentioned data challenges in its daily operations. Even though the solution will be presented in a specific example, the issue at hand is much more widespread. Splunk's report (2025) on data collection and management in organizations shows that 60% of survey respondents labeled half or more of their organizational data as “dark”, meaning that it remains unanalyzed and unused, despite being collected. This shows that this thesis will not only aim to resolve the present challenges at Siliko but can also serve as a pathway to more effective data utilization for many other organizations.

Currently, sales data analysis in Siliko is very time-consuming, as management reports are prepared manually each week, which is inefficient in the modern digital era. The objective is to make the company's sales data more accessible and user-friendly for management and employees. This thesis presents a practical solution to improve workflow and automate report preparation by creating a sales dashboard in Power BI, a business intelligence tool developed by Microsoft. The dashboard transforms Siliko’s sales data into concise, user-friendly visualizations, providing sufficient flexibility for each user’s needs. It shows a number of selected sales metrics, such as segment sales, customer performance, and project success phases, which are regularly analyzed by Siliko management. Presenting them in a dashboard format significantly improves data visibility while reducing the manual work and time required for report preparation, analysis, and further decision-making.

In the following paragraphs, the thesis presents an overview of past, current, and future trends in the automotive industry, business intelligence, and its architecture and data storytelling techniques, supported by literature and real-life examples. It describes business intelligence architecture, industry applications, data storytelling components, and design principles for

effective dashboard creation. The principles described are then applied in a practical context, namely the creation of the sales dashboard. By implementing data storytelling concepts and using Power BI in an actual dashboard case, this thesis highlights the importance of business intelligence as a key tool for easy data analysis and visualization in the modern business environment. In this context, data storytelling is used not only to present a meaningful narrative but also to enable the derivation of reliable insights for further decision-making.

2 UNDERSTANDING DISRUPTIONS IN THE AUTOMOTIVE INDUSTRY

The automotive industry was considered very stable throughout the last few decades. But in recent years, the industry has experienced significant disruptions, making the market more volatile than usual (Gao et al., 2016). The industry was a victim of numerous disruptions, such as the rise of electric mobility, the popularity of ride-sharing/ride-hailing, and the COVID-19 pandemic. For instance, new app-based mobility ride-hailing services gained greater recognition due to a shift in consumer mentality and the inconvenience of public transportation. Companies like Uber, Lyft, Didi, and BlaBlaCar offer users cheap, convenient transportation in urban areas. In his 2016 research, Smith (2016) found that 15% of the American population had previously used ride-hailing apps. Clewlow (2019, p. 3) and Smith (2016) also came to a general consensus that users of ride-hailing apps tend to be younger, educated people with above-average income, who live in urban, densely-populated areas. In their report, Deloitte (2021) predicted that on average, at least 19.000 kilometers per year will be driven with shared mobility means of transportation in the top 5 countries in the European Union (hereinafter EU) by 2035. Given the average number of kilometers driven per year (12.540 kilometers), this would mean that over a third of all the driving will be done through shared mobility. The global ride-hailing market was also valued at over 240 billion euros in 2023, while roughly 19 billion Euros of revenue were generated in Europe alone. Experts argue that the European part of the market will also grow by 4,2% until 2029, while its customer base will reach 195 million users (Carlier, 2023b).

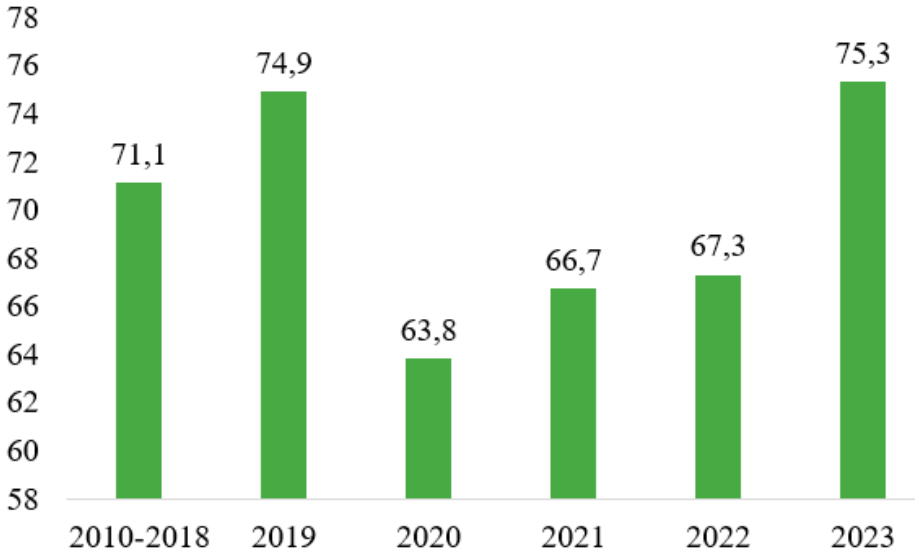
Despite the fact that European cities tend to have better public transport infrastructure, they are on average two times more densely populated (Kumar, 2016), while Europeans proved to be more environmentally concerned (EIB, 2018). Gomez et al. (2021) conducted research on ride-hailing popularity and usage. They established that such mobility services are mostly used for leisure trips in urban areas, with higher demand on weekends. Moreover, 50% of survey respondents see such mobility options as a substitute for a personal vehicle or a taxi, meaning that the adoption level among car-oriented people is quite significant. Being a substitute, mobility-as-a-service options might replace the need for a personal vehicle for some people and thus affect the growth of the automotive sector.

However, as such options gain popularity, a lot of niche opportunities open up to cater to those needs. One example of such an opportunity for automotive suppliers would be the introduction of purpose-built ride-hailing vehicles (Grosse-Ophoff et al. 2017, p. 3). A new vehicle segment would result in a need for new components, assemblies, and solutions. And for companies like Siliko, providing parts to those would mean an opportunity to increase their business operations. Additionally, taking a proactive approach in the development of such components could potentially allow Siliko to become a market leader in the segment, capturing the market in its early development phase. Although the situation with the ride-hailing emergence may look promising at first glance, there were also other disruptions that affected the automotive industry. Thus, it is important to understand the impact of those disruptions and current trends that may influence the market situation going forward.

2.1 Impact of the COVID-19 pandemic on the automotive industry

The automotive industry faced a major setback in 2020, when the whole world was hit by the COVID-19 pandemic. Due to national lockdowns, supply chains were disrupted, and production facilities were temporarily closed. A global drop in vehicle demand was also an evident consequence of this outbreak (Carlier, 2023a). Figure 1 shows the number of cars sold worldwide from 2010 to 2023.

Figure 1: Annual car sales worldwide 2010-2023 (in million units)

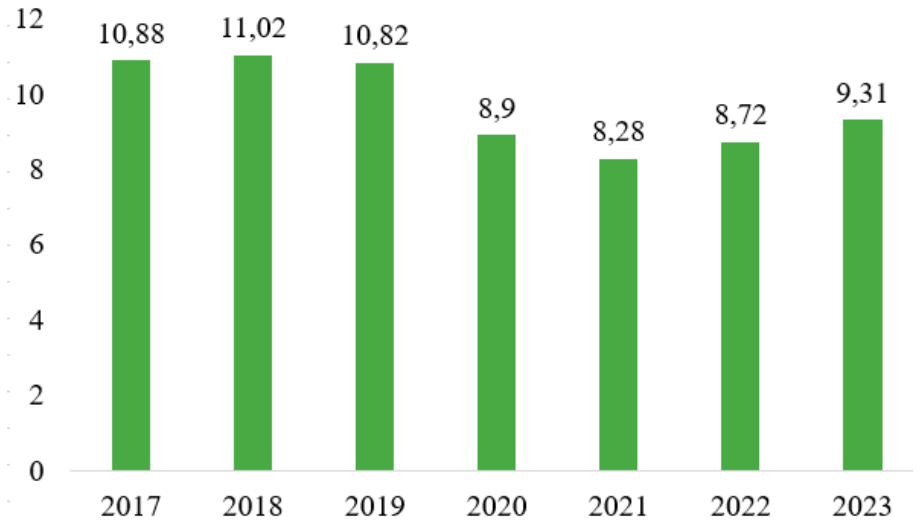


Source: Carlier (2023a).

As we can observe from Figure 1, in 2020, the automotive industry experienced a 15% decrease in demand worldwide due to the COVID-19 pandemic. The effects started in China, reaching the European automotive market in April 2020. Countries with strict lockdowns saw a drop in sales in 2020, as customers were restricted in travel and stopped all non-essential purchases.

The European automotive market suffered even more during the COVID-19 pandemic: the number of cars sold in Europe dropped 66% from March to April 2020 (Carlier, 2024). As a result of lower consumer demand and lockdown measures, almost all European car manufacturers had to decrease their manufacturing outputs, stop production operations, or even close facilities and lay people off. For instance, as shown in Figure 2, one of the biggest German car manufacturers, Volkswagen Group, produced 18% fewer cars in 2020 compared to 2019 (Volkswagen, 2023).

Figure 2: Number of vehicles produced by Volkswagen Group worldwide 2017-2023 (in millions.



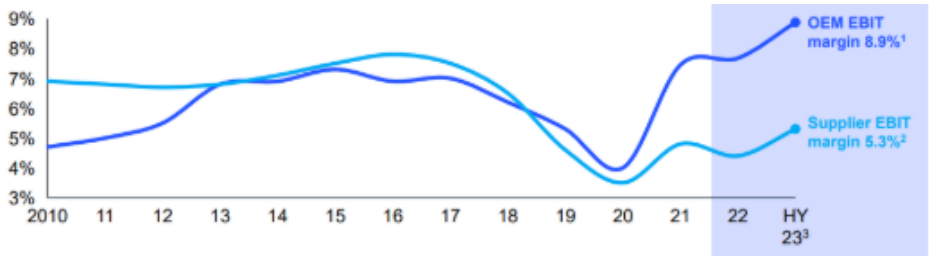
Source: Volkswagen Group (2023).

Decreased demand from original equipment manufacturers (hereinafter OEM) cascaded down the value chain, having a negative impact on rubber production in South East Asia, affecting a lot of smaller, more vulnerable plantation owners and farmers. Even though bigger manufacturers and traders supported their farmers financially, there was still some scarcity, which affected the European rubber supply chain with higher prices and longer delivery lead times. A 2020 survey by the Institute for Supply Management determined that over 80% of companies were impacted by disruptions in the supply chain due to COVID-19. Freight carriers reduced their fleet by 30%, which led to an over 200% increase in container price compared to 2019 (Mesnier, 2021). This resulted in higher costs of both inbound and outbound logistics, impacting the margins and overall financial situation of many companies. Semiconductor shortages, which were enhanced by the increased demand for consumer electronics during the pandemic, only made the situation worse, as we can observe that the numbers in Figure 2 dropped even further in 2021. Due to the shortage, global OEMs cut over 11 million vehicles from production in 2021, resulting in a 26% decrease in automotive production (J.P. Morgan, 2023). To put it into perspective, an average car requires around 1.500 semiconductor chips,

while some models need up to 3.000. BMW reported that their production plans were 10.000 vehicles per week short, while another German car manufacturer, Daimler, reported stops of production lines due to chip shortage (Ewing, 2021). Even though there has been a steady growth in the last few years, the market is yet to reach pre-COVID levels.

The decrease in output and revenues of OEMs resulted in an even bigger impact on Tier 1 (direct suppliers of final products to OEMs) and Tier 2 (suppliers for Tier 1) suppliers, the two areas where Siliko's business lies. According to the European Automobile Manufacturers Association (hereinafter ACEA), in 2020, European Union passenger car production fell by 23.3% in comparison to 2019, while Germany, the primary market for Siliko, experienced a 24.3% decline (ACEA, 2021, p. 3). In Figure 3, we can observe the movement of OEM and Supplier's earnings before interest and tax (hereinafter EBIT) margin over the past decade.

Figure 3: OEM and supplier EBIT margin 2010-2023



Source: European Association of Automotive Suppliers (2023).

As shown in Figure 3, the two lines representing the EBIT margin of OEM and supplier were relatively close to each other, and the distance between them started to increase in 2020. Massive supply chain disruptions, chip shortages, and raw material and energy price increases were all consequences of the COVID-19 outbreak. The cost pressure that already existed has been further increased by high energy prices and logistics costs. OEMs were able to minimize the impact of these disruptions due to having a larger product mix and by focusing on models with the highest margins. Suppliers, on the other hand, did not have that option and had to bear the majority or, in some cases, even all of the higher production costs. Siliko was able to negotiate price adjustments and "share the pain" of previously mentioned increases in raw material and logistics costs with its customers. A significant burden for manufacturing companies like Siliko was also growing energy costs, as the average electricity price surged from being 12 euros per megawatt hour (hereinafter MWh) in early 2020 to over 350 euros per MWh in 2022.

Even though Siliko managed to receive compensation from its customers and mitigate the impact of the crisis on the company, such compensation was far from being the industry practice. Due to having a power position in the market, OEMs did not agree to compensate for the higher production costs of suppliers, which led to negative financial results in many companies. For example, one of the biggest Tier 1 suppliers in Europe, Mahle, experienced a 25% decrease in

revenue and ended a fiscal year with a loss of over 400 million euros (Mahle, 2021). Another example is Hella Saturnus Slovenija (Slovenian subsidiary of Hella Group), which concluded the year 2022 with a 23 million euro loss (CompanyWall, 2024). Many companies in the automotive sector were affected to such an extent that they encountered liquidity issues either during or immediately after COVID-19. One example is automotive supplier Veritas AG, which became insolvent in 2020, while another automotive supplier, Eissmann, filed for bankruptcy at its German locations in 2024.

To sum up, the main impacts of COVID-19 on the automotive industry were:

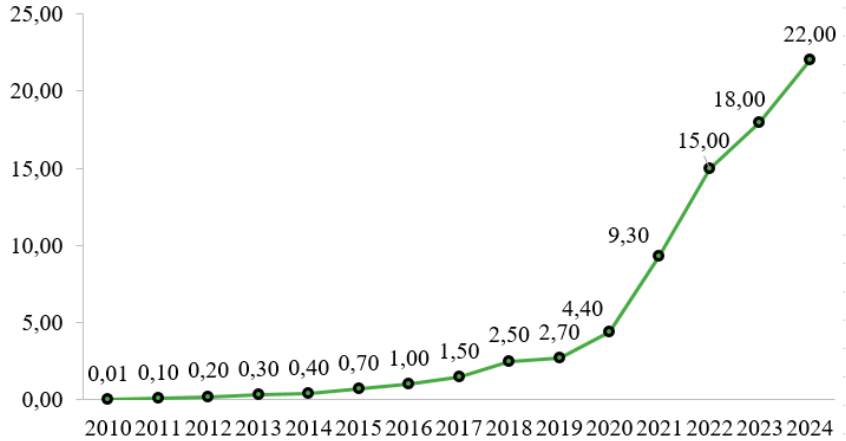
- 15% global sales drop (2020).
- 66% decline in EU sales (March–April 2020).
- Semiconductor shortages cut 11 million vehicles (2021).

Overall, we can argue that due to the pandemic, the pressure on suppliers in the automotive industry increased, and the trend is not expected to be reversed any time soon (Stricker & Correa, 2023). Yet, even though it was very hard to predict an outbreak like COVID-19, BI tools are very useful for early identification of discrepancies. By preventive analysis through the utilization of BI, companies can evaluate performance, establish deviations quickly, analyze trends to minimize risks, and avoid potential problems.

2.2 Global electrification trends in the automotive sector

The first electric vehicles date to the beginning of the 19th century, but achieved mass popularity with Tesla entering the market in 2008. Over the course of a decade, the eMobility market share was steadily growing. Figure 4 shows that electric vehicle (hereinafter EV) sales have rapidly increased from 2017, when they rose above one percent of the market, and have particularly accelerated since 2020, reaching 22% market share in 2024 (IEA, 2025).

Figure 4: Electric vehicles market share worldwide 2010-2022 (in %)



Source: IEA (2025).

Such an increase in EV market share was also evident in Siliko. In that period, the company landed a lot of eMobility-related projects, while company revenue increased 15% year-to-year. Even though EV sales were also increasing globally, it is important to note that the rise is very concentrated. In 2023, almost 60% of new electric car registrations were coming from China, 25% in Europe, and 10% in the United States – corresponding to nearly 95% of global electric car sales combined (IEA, 2024, p. 17). Many factors, like consumer perception, governmental targets, and investments in technological innovation, contributed to the rapid growth of the EV market in those three areas. Many consumers became more environmentally aware during the COVID-19 pandemic and started looking for more sustainable means of transportation. According to research done by Boston Consulting Group (hereinafter BCG) in 2020, 70% of respondents stated they were more environmentally aware now than before COVID-19 (BCG, 2020). Technological improvements in vehicles themselves (increased range, more comfort, better options, etc.), as well as investments into charging infrastructure, have also played a role in the increased demand.

Despite the popularity in more developed parts of the world, the EV adoption trend has hit some obstacles in regions like South America, Africa, and Southeast Asia. The reasons for low EV adoption somewhat differ among those regions, yet there are a few similarities worth mentioning, the most prominent being EV unaffordability. In Brazil, which is one of the bigger markets in South America, the average household income comes to around 300 euros per month (Brazilian Institute of Geography and Statistics, 2024). An average Filipino earns less than 800 euros per month (Jarvis & Wind, 2023), while Nigerians have to live off 190 euros per month (World Salaries, n.d.). Given the low earnings and the prices of electric vehicles on the market, it is safe to assume that the majority of people in those regions do not consider the switch to eMobility. There are also region-specific reasons, for example, Africa's dependency on used vehicle imports. In Ghana, 80% of all vehicles imported have been previously used, and 40% of the 14 million used vehicles that the European Union, Japan, and the United States exported between 2015 and 2018 went to African countries (Madden, 2020). On the other hand, Brazil is among the 10 biggest oil-producing countries in the world. The biggest oil-producing company, Petrobras, is also state-owned. Thus, there is less incentivisation and promotion of EVs coming from the government side (U.S. Energy Information Administration, 2024).

Yet the situation is completely different in the EU, where most of the impact was made by governments and other legislative bodies. From 2020, the European Green Deal aims to make the European Union climate-neutral by 2050. It introduced changes in areas like circular economy, innovation, farming, and, among others, transportation. The European Commission set various milestones towards achieving the objectives of sustainable, smart, and resilient mobility. Among others, the objectives for the EU were to have 13 million low-emission passenger vehicles by 2025 and at least 30 million zero-emission vehicles in operation on

European roads (European Commission, 2020). The effect of the European Green Deal was also seen on the market itself, since, as we can see from Figure 4, the EU experienced a significant increase in electric vehicles market share in the 2019-2020 period. According to the European Automobile Manufacturers' Association, almost all EU countries experienced triple-digit growth in terms of new car registrations when comparing Q4 2020 to Q4 2019 numbers, with the average growth of 216% (ACEA, 2021, p. 2).

The European Green Deal set clear guidelines for the whole European Union in terms of movement towards a more sustainable and climate-neutral way of living. But the majority of policies were put in place by legislative bodies of each member state, thus we can see differences in the EV market situation among EU countries. One of the most proactive and successful countries in terms of eMobility encouragement and adoption was France. Since 2018, the French government and the Ministry of Ecological Transition in particular have been very active in passing numerous legislations and setting governmental targets to incentivize the adoption of electric vehicles among its citizens for both personal and commercial use. For instance, French citizens are eligible for a 75% tax reduction for the installation of EV charging systems at home (Government of France, 2024). The French government also set a target of reaching 100.000 charging points by 2023, and according to the National E-Mobility Association, had 118.000 chargers at the end of 2023 (Avere France, 2024). Moreover, French citizens were eligible for the so-called "Green Bonus": financial coverage of up to 27% of purchase costs for passengers and 40% for commercial vehicles. With a bunch of similar policies, the number of newly registered plug-in and electric vehicles in France increased by 227% from Q4 2019 to Q4 2020 and reached 26.5% market share in 2023 (Avere, 2024a).

Another member state worth mentioning is Germany, which is Siliko's primary market. Even though 95.864 EVs were newly registered in the last quarter of 2020, the market share of electric vehicles in Germany was only able to reach 4,8% by 2023 (KBA, 2024). After analyzing the reasons for such a low market share in comparison to the front-running France, there are a few points worth mentioning. Even though Germany gives up to 9.000 euros of discount for the purchase of electric vehicles and allows a 10-year tax exemption for fully electric vehicles, there are many fewer governmental policies that tackle the lack of charging infrastructure. According to the Federal Ministry of Economic Affairs and Climate Action, Germany plans to achieve 1.000.000 charging points by 2030, but experts argue that in order to achieve that goal, the rate at which they are built needs to be tripled (Platini, 2023). Roland Berger compared public charging port sufficiency (vehicle to charging point ratio) in both Germany and France.

Figure 5: Public charging point sufficiency (vehicle-to-point ratio) in H2 2022

Source: Lohrisch (2023).

As we can see in Figure 5, France has almost 3 times more public charging points available for their EV users compared to Germany and almost double the amount of the global average. Moreover, research by the German Association of the Automotive Industry (VDA) from 2023 concluded that over 48% of communities in Germany do not have a single charging point available. This data clearly shows the lack of infrastructure and thus explains the low share of electric vehicles in the German automotive market at that time in comparison to their French neighbors. However, it is worth mentioning that there are laws directed toward improving the situation. For example, German Chancellor Olaf Scholz stated that from 2028, all German gas stations will have to be equipped with a fast charger. With this law, the government plans to add around 11.000 charging ports to the network. Yet another concern regarding charging stations is their timeliness and capacity. Swiss company Sortimo has built a 144-point charging complex on the highway between Munich and Stuttgart. However, when put into perspective, this does not seem like such a drastic improvement at all. On paper, this charging complex allows for charging of 1,5 cars per hour, while a normal gas station serves 10-15 vehicles in a few minutes. Thus, even though some chargers are capable of delivering up to 150 kilometers of range within 10 minutes, it is still far from the refueling convenience that internal combustion engine (hereinafter ICE) vehicles offer (Martin, 2018).

To sum up, electric vehicles are still going to be produced and sold in the EU market, just at a slower pace. Given the current state of infrastructure and vehicle development, it is safe to say that the EV market in the EU will not experience such a high growth rate as it did in the years 2019-2022, but the growth will definitely continue, and EVs will play a role in shaping the future of the automotive industry. Due to the rise of environmental awareness among citizens post-COVID and the increase in popularity of car-sharing and ride-hailing options, it is safe to assume that electric vehicles will still have their place in the automotive world. Additional

demand will also come from enterprises, which are becoming more interested in purchasing an EV as a company car. Such purchases are often tax-exempt: UK companies pay 0% tax rate on EV purchases (UK Government, n.d.), while German ones pay 0,25% tax with additional exemptions and subsidies for on-the-job charging (VDA, n.d.). OEM producers will also be able to achieve higher sales in the emerging EV markets like South America and Southeast Asia. However, the situation on the sub-supplier side is expected to be more difficult. The general level of competition is much higher among Tier 1 and Tier 2 suppliers. Thus, geographical location and global presence of companies start to come to the forefront due to higher logistic costs, sea freight lead times, and general inefficiencies of long transport routes. For instance, Volkswagen is now moving its EV production to more cost-efficient countries like Mexico (Reuters, 2024), and it will be hard for European companies like Siliko to compete for projects delivered there, especially given the lower production costs in such countries. As mentioned previously, geographical location and production facilities in low-cost countries currently present a significant competitive advantage for companies. Accompanied by a slight stagnation of the EU market, I expect a lot of movement and expansions in those areas, either through direct acquisitions or joint ventures between companies. This can be a great opportunity for suppliers to expand in those geographic areas and gain a competitive advantage with lower production costs and being closer to their customers.

2.3 Market entry of Chinese automotive manufacturers into the European Union

China introduced a renewable energy law back in 2005 to stimulate the usage of renewable energy sources. Through the early 2000s, the Chinese industry received multiple financial injections to overcome the financial crisis and further facilitate development (Xiaoying, 2023). In 2015, China issued a “Made in China 2025” plan with the aim of further developing the manufacturing sector. The goal was to upgrade manufacturing capabilities from labor-intensive activities towards more technologically advanced operations. This strategy aimed to increase the competitiveness and market share of the Chinese manufacturing companies globally, as well as lower the dependency on foreign suppliers (PRC State Council, 2015, p. 5).
Consistent government support, together with low-cost domestic supply and economies of scale due to market size, allowed China to become the production and export leader in 3 areas: solar cells, lithium-ion batteries, and electric vehicles.

In recent years, China has also become the world's largest electric vehicle market. To achieve this, the Chinese government passed a series of policies to incentivize the adoption of EVs in the domestic market. Also, numerous subsidies and credits gave Chinese automakers an opportunity to continuously develop. For instance, in 2022, subsidies to car maker BYD amounted to 2,1 billion euros. With the help of such policies, China is becoming an important player also outside of its domestic automotive scene. In 2023, China exported over 31 billion

euros worth of electric vehicles, 40% of which went to Europe. This allowed Chinese OEMs to reach 9,3% market share in 2023, which is an exponential rise from 0,5% in 2019 (Bickenbach et al., 2024, p. 22). Such an exponential rise in numbers facilitated a response from both the United States and the European Union.

The Biden administration called the surge of Chinese EVs a threat to national security, and significant legislative actions were put in place to prevent further market penetration. For instance, the tariff rate for Chinese semiconductors will be increased from 25% to 50% by 2025, while electric vehicles will have a 100% tariff rate already in 2024. Also, tariffs on batteries, solar cells, and steel were significantly increased (The White House, 2024). The US electric vehicle market is largely dominated by domestic producers, and imposing high tariff rates is a way to protect and maintain the leadership position (Wang, 2024).
On the other hand, actions from the European Union were not so drastic. An investigation launched by the European Commission concluded that Chinese EV manufacturers benefit from unfair subsidies, which presents a threat to European producers. Provisional tariffs of 17,4%, 19,9%, and 37,6% were put in place for the 3 biggest players in the market, BYD, Geely, and SAIC. Other EV producers that cooperated in the investigation but were not sampled received a 20,8% import duty, while non-cooperating companies now face 37,6% tariffs. Since these import duties are only provisional and valid for only 4 months, it is now unclear what the final decision by the EU will be. However, in that timeframe, we can expect that some sort of permanent regulation will be put in place (European Commission, 2024).

It is clear that the two approaches taken differ significantly in their core. While the EU uses its legislation to regulate and even out the playing field for both domestic and Chinese EV producers, it is clear that the US government has protectionist intentions for this matter, which is their usual logic when dealing with Chinese producers (Chinese smartphones, social media, e-commerce, etc.). Even though Chinese EV export to the USA amounted to 368 million dollars and such strict regulations might seem excessive, the case of Chinese 12,4 billion euro worth export to the EU might be a concerning example for American legislative bodies. An overview of global EV adoption trends is presented in Appendix 1.

When it comes to the US government policy, I expect no future change in their protectionist approach towards China. As with all Chinese products, the United States does not want them to gain market share on US soil, thus double or even triple-digit import duties were usually applied. I predict that this trend will only continue, as there are no signs of any possible tariff reductions, regardless of government leadership. However, my prediction is that there will be some changes in the European automotive sector. Despite high tariffs, I think we can still expect a bigger EU market entry from Chinese OEMs within the next 5 to 10 years. The market is already there, as 27% survey participants confirmed to McKinsey & Company (2024, p. 3) that they would

consider buying an EV from a Chinese brand. From the regulations in place, it is also clear that European legislative bodies do not aim to refuse entry to Chinese electric vehicle producers, yet just want to "even out the playing field". It is also safe to assume that not a lot of companies will be able to make an EU market entry. Given the high capital expenditures needed and possible requirement to move (at least partially) the production within EU borders, some companies will not find economic sense in the geographic expansion. The entry from Chinese OEMs will also be beneficial for European manufacturers, as it will create new business due to the localization of the supply chain. Bigger and bulkier components (water tanks, air deflectors, etc.) will definitely be sourced locally, as transportation costs for such products are usually higher due to their volume and inability to transport efficiently. Given the know-how and an already strong market position in Europe, EU manufacturers like Siliko will definitely have an opportunity to produce components also for Chinese vehicles.

Entering the Chinese supply chain will be a key goal for any European manufacturer in the upcoming years. As the influx of imported electric vehicles is to be expected, this would to some extent replace the sales of EVs produced by European manufacturers, subsequently reducing component needs and sales revenue of Tier 1 and Tier 2 suppliers. By becoming a supplier to the Chinese, companies can compensate for the decreased order numbers from Europeans and win important market share for many years ahead.

2.4 Analysis of current trends in the automotive industry

After the exponential growth from 2019 to 2023, the momentum of electric vehicles seems to have slowed down. Since the beginning of 2024, there have been on average 12% fewer battery electric vehicles registered in Europe per month in comparison to numbers in 2023 (ACEA, 2024). With such movement, the EU's plan to have all zero-emission vehicles by 2035 seems like a hard goal to reach. One of the biggest reasons for the decrease in new battery electric vehicle registrations in Europe is the governing bodies of each country. After widespread purchase incentives and tax exemptions for the purchase of EVs, European countries started to pull back on those subsidies at the end of 2023.

Table 1: New car registration in 2023 vs 2024, by month

	% change 2024/2023			
	February	March	April	May
Germany	-15,4%	-28,9%	-0,2%	-30,6%
Finland	-28,2%	-35,6%	-28,5%	-32,1%
Ireland	-15,7%	-41,4%	-41,6%	-39,4%
Sweden	-14,6%	-33,7%	-1,8%	-34,7%

Source: ACEA (2024).

As we can see in Table 1, the cancellation of subsidies and different types of incentives resulted in a double-digit decrease in the number of registered battery electric vehicles in 2024 when compared to the same period a year before. For example, Germany paid out around 10 billion euros in subsidies since 2016, and 90% of all EV purchases in the country were subsidized. However, in December 2023, the government decided to cancel all EV subsidies due to a budget crisis in the country. Table 1 shows that since ending the subsidies, the registration rate experienced a significant drop, meaning that the goal of 15 million electric vehicles on German roads by 2030 might be a tough target to reach. The business case is the same with Finland, Ireland, Sweden, as well as many other European countries: a lot of investment and incentivisation was put into electrification, yet the adoption rate was much lower than expected. Now, after subsidies have been eliminated due to a lack of budget funding, carbon neutrality targets will be hard to achieve with such low interest coming from the consumer side. It is clear that governmental subsidies have made EV purchases more attractive to a lot of people, as the data shows sales numbers have declined significantly since their removal.

However, there are consumer-driven factors that have influenced the adoption of electric vehicles within the general public in a negative way. Consulting group McKinsey & Company (2024) conducted a survey on how consumers perceive electric vehicles and eMobility in general. According to this survey, 45% of surveyees do not want to switch to EV due to the price, 33% due to charging concerns, and 29% are concerned about the driving range. Additionally, 29% of people who currently own an EV would like to switch back to an ICE. Among the top reasons for a switch, people state previously-mentioned charging infrastructure problems, high costs of ownership, and impracticality of the driving range. The public opinion in Germany is also pretty much cohesive with the findings of the McKinsey & Company survey. A German automotive club survey showed that 59% of German citizens will not consider buying an electric vehicle, with 31% completely ruling out this option. Price was also established to be

the primary decision criterion, with 55% of surveyees naming high subsidy as a key argument in favor of EV purchase (ADAC, 2024). Additionally, high price was also named as the main turnoff by 71% of respondents, followed by insufficient charging infrastructure at 64% and other reasons like charging times and limited range (Kedzierski, 2024). Given the fact that electric versions of the same car models are sometimes significantly more expensive than their ICE counterparts, it is clear that price obstacles need to be tackled in order to facilitate higher EV adoption rates in Germany. Thus, the elimination of subsidies was definitely not a step in the right direction.

The level of charging infrastructure development is also an important factor that consumers consider when deciding whether a switch to an EV makes sense for them. However, as mentioned previously, the infrastructure development lagged behind an exponential growth in EV market share around the world, particularly in Europe. For instance, since 2017, the number of electric vehicles on European roads has multiplied by 18, while there are now only 6 times more charging points. It is also important to note that the dispersion of charging ports around Europe is somewhat poor: 61% of all chargers are located in the Netherlands, Germany, and France. Thus, the adoption of eMobility in other EU countries is even a bigger challenge for regular consumers.

A lot of companies have invested significantly in research, development, and equipment for the production of EV-related components specifically. Audi created a tailor-made battery production department in their Brussels facility in 2018, where it assembled the Q8 e-tron model (Audi, n.d.). But due to poor sales of the model and a somewhat turbulent period for the whole Volkswagen Group, the company announced factory closure by February 28, 2025 (Reuters, 2024). There are numerous examples where companies purchased machinery, built assemblies, and invested heavily in expansion for the purpose of producing EV-related products. With already decreasing sales numbers in the EV segment, such equipment is now becoming a financial burden and a loss-maker for many producers. Despite the efforts from governments to push eMobility as much as possible, it is now clear that consumers do not share the enthusiasm completely. The technology is still somewhat new and is constantly being developed. It is possible that some EV-related products, like battery venting units or battery pack gaskets, will not be used in the future at all. This risk should be accounted for, and companies should not become heavily dependent on technology or products that might not be needed in a few years. Existing equipment should be repurposed, while it is also a good idea to search for synergies among different projects and compete for those where they are achievable. The products might not be exactly the same. However, the technologies used and the production process can be shared among different items in order to reduce per-product costs.

However, the situation is a bit different when it comes to petrol or diesel vehicles. The technology itself has been present for decades, and it is unlikely that revolutionary changes will be brought to the market. It is, however, risky in terms of the long-term application of ICE, as governments are still considering the move to sustainable ways of transportation, but maybe further down the road, in e.g., 20 or 30 years from now. With the potential resurgence of ICE in the current market, it would be highly beneficial to at least try to achieve some balance in product portfolios in order to prevent additional uncovered expenses in the long run. Overall, it is important for companies to monitor all the incoming projects and try not to be highly dependent on one particular segment. As many suppliers were heavily determined to make a breakthrough in the EV segment, it now shows that the ICE segment cannot be forgotten as well. Balancing of incoming projects is highly needed in order to avoid complete dependency and lower the risk of doing business.

2.5 Future outlook of the automotive industry

Despite recent decline and reduction of subsidies across EU countries, it is clear that eMobility is still the future of the automotive industry. We are experiencing a drastic transformation, and global carmakers will be bringing more and more models to the market in the next decade. After significant growth in 2019, it is only logical that we have now reached a cool-off period, where the situation will stabilize. Experts argue that in the upcoming years, we will see a lot of EV model discontinuations from big OEM producers and can even expect closures of smaller EV manufacturers. Consumers have experienced the benefits and drawbacks of electric vehicles, and in most cases, the level of infrastructure development does not allow for carefree usage (IEA, 2024, p. 125). Much lower sales of electric vehicles, and subsequently products related to electric platforms, are to be expected in the upcoming years. One might argue that hydrogen fuel cell cars will fill the gap coming from decreased EV sales, but despite the enthusiasm in the global media, there are no clear signs of development coming from the automotive producers' side. It is safe to say that hydrogen fuel cells will need a lot more time before they reach the numbers electric vehicles currently have. On the other hand, according to research by ACEA (2024), petrol and diesel cars will be back on the rise in the upcoming years.

Another trend to expect is a general decrease in the prices of electric vehicles. As mentioned previously, a survey by McKinsey & Company (2024, pp. 10–11) showed that high prices are a turn-off for almost 50% of people when purchasing an electric vehicle. Total cost of ownership for an EV in comparison to an ICE car is still much higher, and with governments cutting out subsidies for the purchase, the discrepancy is becoming even more evident. Electric vehicles are more expensive to maintain, depreciate more, and are harder to sell on the second-hand market. All these factors influence consumers' decisions to deviate from purchasing an electric vehicle at such a high total cost. To make EVs more attractive, producers will need to decrease vehicle

prices significantly. As mentioned previously, since 2020, the difference between OEM and supplier EBIT margins has been increasing. OEMs are playing a “stronger hand”, so it is only logical that they will try to minimize the impact of the retail price decrease as much as possible. To achieve that, we can expect the usage of more standardized products across different car models from the OEM side. Every differentiation is an additional cost, thus putting the same components in multiple car models will allow OEMs to achieve higher economies of scale and request lower prices from suppliers due to increased volumes.

Technological advancements will also play a significant role in decreasing the EV prices. In the automotive sector, vehicle manufacturers are driving technological development. With battery technology constantly improving, we can expect that cheaper solutions will be used in the manufacturing process, especially given the fact that it is in the direct interest of car manufacturers to enter economically less developed markets. Due to power dynamics in the market, Tier 1 and Tier 2 manufacturers will have to reduce prices in order to remain competitive, which will also facilitate additional know-how development on their side. Global presence and geographical proximity to the customer are also things that can be a competitive advantage for suppliers. Logistics costs for bulkier and voluminous items are usually very high, and it does not make economic sense for car manufacturers to ship them across the globe. Additionally, the sustainability and carbon footprint of such transport routes have to be taken into account as well. As many OEM producers have their production facilities in Latin America or India, it can be beneficial for suppliers to be present in those areas as well, ensuring shorter logistic routes.

Moreover, developments in the supply chain are also to be expected, as companies will be looking into cheaper materials for production. New suppliers with lower material prices are expected to emerge, while existing ones will be battling for market share with lower prices.
Experts predict an increased market share of electric vehicles in South America, Africa, and Southeast Asia. However, it is worth mentioning that Chinese car manufacturers will most probably be dominating those regions by a high margin, unless some significant price reductions are achieved from EU manufacturers. Due to lower economic development and low consumer purchasing power, European or even American vehicles are simply too expensive for the regular population in those parts of the world, thus EV price reduction is a key goal for European OEMs in order to be competitive in those regions The claim is also supported by data from the International Monetary Fund: gross domestic product (hereinafter GDP) per capita at purchasing power parity in the EU is 58.840 international dollars, while 20.110 and 18.900 in South America and Asia (IMF, 2024). This clearly shows the inability to compete in these markets with EU price levels, which leads to the belief that Chinese car manufacturers will have a strong position in those regions. Competing with Chinese manufacturers in terms of price is very hard due to higher costs of production, meaning that price reductions from EU manufacturers are

inevitable. Related to the previous point, supply chain diversity and resilience will be put to the test in the upcoming years. With lower price demands coming from OEMs, having the ability to source cheaper, yet still quality materials will determine the difference between those who will be able to survive the market pressure and those who will experience problems going forward. Projects in the automotive industry are usually nominated two to three years before the start of production for a duration of up to ten years.

In essence, it means that your price has to be competitive today in order to have work for the next ten years. Suppliers with the most diverse and dispersed set of sub-suppliers will be able to adapt to the situation, while the more rigid ones will experience significant problems in the foreseeable future.

3 BUSINESS INTELLIGENCE

In the rapidly evolving business environment, the ability to extract value from data is a key milestone for companies that are trying to improve their business performance in highly competitive business environments. Information is what leads the decision-making process in modern enterprises. Modern managers should not rely on the "gut feeling" and subjective assessment of the situation, but must support their decisions by thorough analysis of the environment (Ong, 2001). Previously, numerous different systems were created to analyze a firm's internal resources (enterprise resource planning, hereinafter ERP), the firm's customers (customer relationship management, hereinafter CRM), or store data (data warehouse). But now we have the ability to merge all this functionality into one technological solution, which is called business intelligence. By definition, business intelligence refers to computer-based techniques used to spot and analyze corporate data, such as sales revenue, costs, income, etc. It performs a very typical problem all managers have been doing for years: analyzing the environment in order to make the best possible decision in a given situation. However, now this process takes seconds to complete, and actionable insights are only one click away (Hočevar & Jaklič, 2010).

3.1 Business intelligence applications in the automotive industry

Insight and data are crucial in any industry, but when it comes to automotive manufacturing, accurate data can be the difference between success and failure. With changes in market conditions and cost pressures that are predicted for the foreseeable future, the importance of data analytics will become even more evident. The current state of vehicle technology provides an ability to gather data through sensors, radio frequency identification (hereinafter RFID) chips, barcode readers, and the Internet of Things. With proper system integration and alliance, business intelligence is a useful tool to help make data-driven decisions in all areas of automotive manufacturing. Even though the cases of BI utilization for car manufacturers are not publicly known, the theoretical benefits of such applications are very promising. For instance,

business intelligence systems can help manage demand fluctuations and inventory levels, while also preventing capacity constraints in terms of labor, materials, or capital. Reduced inventory levels will result in decreased warehousing and inventory holding costs, which can be a significant saving, depending on the inventory size (Naude & Badenhorst-Weiss, 2011, pp. 93–94). An example of BI benefits in the automotive industry is the case of Volkswagen AG. The group uses the SAP S/4HANA business intelligence system, which helps them enhance their business operations (Westernacher, n.d.). The data is continuously gathered and categorized by patterns for further analysis and insight derivation. This allows management to carry out performance analysis and determine deviations from the planned volumes, margins, and turnover. It also gives the company the ability to align its supply chain needs with current demands and extend traceability of its components, improving the production process (Visiani, 2022, p. 19). Another well-known automotive producer, Ford, uses data and business intelligence to optimize production. In 2019, they created Miniterms 4.0, a system that predicts production downtimes and notifies workers about reduced functionality of the equipment (Harvard, 2023). According to the company itself, the system saved them over 1 million euros in the first year alone (Ford, 2020). Similarly, Predictive Maintenance 4.0 by Bosch (n.d.) analyzes data patterns and trends, which allows them to predict when a piece of equipment is likely to fail. Through the implementation of this system, the company can perform maintenance works at an optimal time, reducing unwanted downtime and improving production activities.

With the pressure from OEMs to reduce part prices, the use of BI systems can help production managers identify inefficiencies and bottlenecks at their plant, help procurement track raw material prices and supply, as well as allow top management to monitor the financial performance of the company. Connecting BI systems to the company's ERP system can provide an opportunity for real-time monitoring of key performance indicators and reduce decision-making time. Business intelligence systems also allow for sales forecasting, which can be very beneficial given the potential uncertainty in the automotive industry in the future. Orders from original equipment manufacturers are subject to change, regardless of previously given forecasts, and suppliers have almost no protection from such fluctuations. A data-driven forecasting system can help predict discrepancies between forecast and actual orders. This allows companies to improve machine utilization, achieve greater flexibility to change, and increase profits.

3.2. Business intelligence systems architecture

There are different types of business intelligence systems architectures, which differ based on their structures, like components, relationships, etc. However, most researchers agree that there are three functions being performed in every business intelligence system. Ereth and Baars (2020, p. 5350) describe them as data management (storage and integration), data processing

(analytics, forecasting, machine learning, etc.), and data management (reports, visual analytics). Even though the names and elements of every BI architecture differ from one another, these three core functions are present in all of them. For instance, architectures of Shariat and Hightower (2007) and Turban et al. (2008) include data warehouse, end-user applications, and portal as structural components of their BI system. However, Ong et al. argue that BI architecture should be constructed of five layers that would include new features of business intelligence systems. They also argue that one of the limitations of previously accepted architecture frameworks is unidimensional data flow, meaning that no data adjustment can be performed in case of errors.

Based on the proposition of Ong et al. (2011, p. 3), the first layer of the architecture is the Data Source Layer. Here, the data is captured from internal (data about products, customers, sales data) and external (data from the Internet, business partners, market research) data sources. The next layer is the ETL layer. It primarily performs 3 functions: extraction, transformation, and loading (Baars & Kemper, 2008, pp. 136-139). In the first step, the data is extracted from different sources. It is then transformed, cleaned, and sorted in the second step, and is loaded into the storage afterward. Then comes the layer of Data Warehouse, which is one of the most important parts of the BI infrastructure. Here is stored both real-time data for operational decision-making, as well as historical, summarized data for the purpose of long-term analysis. Lastly, BI architecture includes an End User Layer, which is a layer of tools for building queries, reporting, and displaying information through visualizations (Ong et al., 2011, p. 6). It is important to mention that in their paper, Ong et al. argue that there is a need for an additional layer called the "Metadata layer". It is used to store technical information about data, definitions, sources, and transformation rules. The purpose of this layer is to save time on development, simplify potential maintenance, and enable easier upgrades in the future (Giovinazzo, 2003). In his article, Harshawardhan (2024), however, states that there are four elements to a BI architecture: data sources, ETL layer, data clouds, which are comparable to data storage in other theories, and a visual interface. Overall, it is clear that all theories describe BI architecture as composed of different layers, yet the functionality of each layer is very comparable across research.

As the main goal of this master's thesis is to improve data accessibility and insights derivation for Siliko by creating a dashboard in Power BI, the majority of my work will be performed on the "End User Layer". However, it is also important how organized the data in my internal sources will be. Thus, I expect a need for some manipulation with internal sources on the "Data Source Layer" as well.

3.3 Benefits and challenges of business intelligence systems for organizations

BI systems allow for a historical, current, and predictive view of company performance and operations (Cebotarean, 2011). This makes BI systems an important support pillar for decision-making on both strategic and operational levels. Through combining gathered data with analytical tools, business intelligence systems provide actionable insights to both lower-level and top management. Nowadays, BI systems are a combination of multiple previously developed systems for decision-making. They provide functions of data warehouses, customer relationship management tools, online data processing systems, etc., while presenting actionable insights through different types of visualizations. As mentioned in previous paragraphs, BI systems allow us to obtain critical information in real time, which gives companies more time to evaluate and think about the decision they are going to make. Data overload is sometimes even worse than data scarcity, since converting huge amounts of data into valuable insights can present a significant challenge. Having a business intelligence system do the analysis and present findings in an applicable and actionable manner can be a huge advantage. They allow companies to make better use of currently existing data, since having the ability to anticipate upcoming scenarios and see potential opportunities can be the difference between success and failure (Hannula & Pirttimaki, 2003, pp. 593-594).

Despite all the benefits, implementing a BI system in the company might also include multiple obstacles, which can prevent the organization from achieving its desired goals. Data quality is one of the most prominent challenges of BI implementation. For instance, duplicate entries or outdated information can compromise decision-making. Poor data can lead to unreliable insights, resulting in unwanted effects for the company. Employees also play a significant role in how successful the implementation is going to be. They may resist the adoption of a business intelligence system due to comfort with existing ways of work or fear of the new technology. Such resistance can hinder the implementation process and prevent the company from achieving desired results. However, even if the adoption itself might not present an issue, users will struggle to implement a business intelligence system in their day-to-day operations without proper training and onboarding. This can result in underutilization and prevent the organization from leveraging the full potential such systems have. Another challenge companies face is the complete costs of BI system implementation. BI solutions usually need a license to be used, which can be costly, especially for bigger firms. Many organizations might also need to invest in servers and storage equipment to successfully operate with the new BI system. Additionally, employee training costs also need to be taken into account, as the usage of such systems is usually not known to the majority of people. BI systems do not run on their own. Thus, maintenance and support costs also need to be accounted for. Lastly, ensuring data security and privacy is critical when talking about business intelligence systems. Organizations must put necessary measures in place to save confidential information from unauthorized access from

outside. Breaches can also happen from the inside of the company unintentionally, e.g., if users export the data and save it on their local device. Strong access controls, encryption, and regular security audits are needed in order to ensure data safety. Such measures often require expertise to set up, maintain, and check regularly, which is usually expensive.

While Business Intelligence systems offer significant advantages by providing valuable insights for decision-making, their implementation can also present various challenges. Successful adoption of BI systems requires proper training, infrastructure investments, and ongoing support to ensure they deliver their full potential. Ultimately, while BI systems can be a powerful tool for enhancing company performance, companies must first evaluate whether the implementation would be successful, as it requires careful planning, adequate resource allocation, and commitment on all organizational levels.

4 DATA STORYTELLING

In the rapidly evolving business environment, the ability to extract value from data is a key milestone for companies that are trying to improve their business performance. Gathering information, performing calculations, and simulating outcomes are core analytic functions of every business intelligence system. In the general context of a modern organization, a BI system is an important decision-making tool that converts data into information, useful on all organizational levels. Manufacturing companies in particular might benefit from such systems through analyzing patterns in defects, finding an underlying cause, and also monitoring the situation to prevent it from happening in the future. Through predicting demand fluctuations and optimizing inventory levels, business intelligence systems bring a lot of added value to a company, while also preventing capacity constraints and optimizing costs. Great connectivity to ERP systems is an additional plus, which makes BI systems a must-have tool in modern, uncertain business environments. However, unless insights are derived from the data at hand, and subsequent actions are taken, analysis system implementation does not make sense. The real value of BI is still very human-dependent. Even with all the data available, it is a question of how one can successfully build an appealing narrative, tell a convincing story, and persuade people to take action (Chandrasekar, 2019).

4.1 Data storytelling and its role in decision-making

Data storytelling is a way of communicating with an organization's stakeholders (owners, employees, suppliers, etc.), tailored to the specific needs of each group. It allows effective communication of insights from datasets by using narratives and different visualizations (Cote, 2021). In its core, data storytelling is similar to human storytelling, but with a graphical support of evidence through charts and visualizations (Microsoft, n.d.). Telling a story with data allows us to put the data into context and helps break down the results. In the context of decision-

making, it makes complex data easier to understand, thus facilitating evidence-based and more thought-through decision-making. Additionally, storytelling techniques foster audience engagement and make data easier to remember and understand through the simplification of complex relationships. They also highlight the important parts, making them stand out in large amounts of data points, making insight derivations much easier. Finally, data storytelling can also facilitate deeper discussions inside teams, since the narrative can be shared more easily in comparison to plain numbers and percentages (Mattison, 2023).

4.2 Data storytelling components

Based on research, we can observe that there are three components to data storytelling: data, narrative, and visualization. All of them have a specific function in the data story, and it is important that they are chosen and prepared correctly.

4.2.1 Data

Definitions and interpretations of data differ among a variety of sources. According to the Cambridge Dictionary, "Data is information, especially facts or numbers, collected to be examined and considered and used to help decision-making". Others argue that "Data becomes 'information' when analyzed and possibly combined with other data in order to extract meaning and to provide context. The meaning of data can vary depending on its context." (US government, n.d.). The difference between the two definitions is clear: in the first example, the data is already information by default, while in the second, manipulation is required for data to become information. The latter is also supported by the Data-Information-Knowledge-Wisdom (DIKW) pyramid, described in detail by Ackoff in 1989.

Figure 6: Data-Information-Knowledge-Wisdom (DIKW) pyramid

Source: Fricke (2018).

The pyramid shows data at the bottom of the hierarchy as an unprocessed, symbolic representation of some observable properties. Next up in the hierarchy is information, which Ackoff defined as relevant, meaningful, or processed data. By asking a question beginning with 'who', 'what', 'where', 'when', or 'how many', the data is processed into an answer and thus

becomes a piece of information. The author defines knowledge as know-how, which is obtained through learning, either from someone's instruction or personal experience. Lastly, Ackoff sees wisdom as a point where ethics or morality is included in the whole picture. However, the model received criticism and was deemed to be unfit for modern business. Weinberger (2020) stated that knowledge cannot be obtained by applying filters to every step of the pyramid, and it is much more complex and creative. Moreover, in her work, Gitelman (2013) completely disregards the statement that data is something pure and unprocessed, implying that even a photo does not represent reality, nor is it data, but a piece shaped by a photographer. Even though the definition of data is still up to interpretation, the key question here is not what data really is, but how to work with it and how it can be used to tell a story.

A basic understanding of different data types and characteristics is still needed in order to use them for delivering the correct message. There are numerous types of data groups based on how it was collected, its structure, cleanliness, and the type of actions we want to perform on it. For instance, all non-numeric data points that are collected from text or images are called qualitative data, while numerically represented data is called quantitative. Structured data is arranged and formatted in a specific way to allow for easier entry, search, and manipulation. It is usually stored in a spreadsheet with columns and rows, with columns representing a category of information and rows being data entries. Its counterpart, unstructured data, is not organized in a predefined way. It can include photos, videos, and other non-textual or numeric entries. Such data is not suitable for database creation. When getting data from both internal and external sources, data quality is a real concern, and bad data can lead to incorrect decisions. In their analysis, people often choose the wrong data or, even worse, underperform in terms of data preparation, which ruins the usefulness of the whole analysis. A 2016 IBM study discovered that due to poor data, the US economy is short 3,1 billion US dollars per year (Bansal, 2021). Bad data does not necessarily mean wrong values. Unstructured, uncleaned, or even lost data also falls into the "bad" category. Bad data also robs organizations of creating new leads and opportunities to develop their business further. (Goetz, 2018). Data is the base for creating a narrative, and if it is not prepared correctly, the key message it tells will be incorrect. Thus, data cleaning and preparation are important steps before performing the analysis (Chu et al., 2016).

Data cleaning is the process of identifying and correcting errors in data sets. Cleaning data significantly reduces the risk of errors and inaccuracies. This is essential for data analysis and allows organizations to make data-driven decisions with greater confidence. It has a substantial role and is essential in later phases of data storytelling, since data is the baseline for narrative and insight derivation (Kowieski, 2022). It is clear that data lies at the core of every Business Intelligence system and is a baseline for data storytelling, which can help companies gain a competitive edge in the modern business world, as it can help organizations improve efficiency, predict demand, and better understand clients. Yet, it is important to choose the appropriate data,

set the correct strategy, and assign responsibility to the right people to make it work effectively (Deepala, 2023, p. 5).

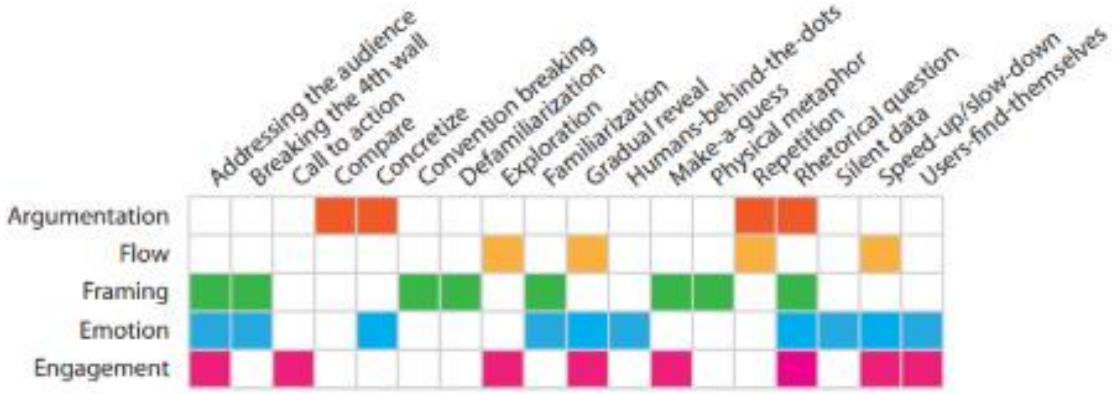
4.2.2 Narrative

The second component of data storytelling is narrative, which is used to communicate insights from data at hand, the context surrounding it, and the recommended course of action (Cote, 2021). Narrative shapes a chain of events into a story, making it compelling and easily understandable for the audience. It can be told in a number of different ways, putting emphasis on different points and calling for different actions. Each variation will most likely affect the audience differently, thus it is important to keep in mind what message we want our narrative to transmit (Bach et al., 2018).

Just like a regular story read in a book or seen on television, a data story uses the same narrative elements: characters, setting, conflict, and resolution (Mariani, 2022). These elements can differ depending on the issue at hand and the action the data story is meant to inspire. For instance, a sales dashboard might not have actual characters, but the customers and employees of the company can be considered as such, since the target audience is directly interested in this data. In this case, top managers are the final audience of such a dashboard, since the financial performance of a company is their responsibility. The setting would be an overview of total sales revenue for each customer of a particular company and its comparison to the previous period. Conflict can be described as a discrepancy between the current and previous year for a particular customer, as well as between customers themselves. Lastly, the resolution stage would be a suggested action based on the data discrepancies shown by the conflict (Alamalhodaei & Feigenbaum, 2020, p. 28).

People have been telling stories with data for a long time now and have also created different narrative patterns that proved to be effective for audience engagement. In order to use them, however, it is important to have an understanding of three aspects: what story you want to tell, who your audience is, and what kind of effect your narrative should have on the audience. All these should be determined by the presenter, and subsequently, the right narrative pattern should be used for storytelling. Figure 7 shows different narrative patterns with the corresponding effects they have on the listener.

Figure 7: Narrative pattern groups and effect on the listener



Source: Bach et al. (2018).

All narrative patterns can be utilized and implemented in the context of a sales dashboard. However, based on the effects mentioned on the top side of the figure, argumentation and engagement patterns look the most appropriate ones for the case. For the Argumentation pattern, one of the most common techniques used is “comparison” between two or more categories in the dataset. Comparison allows the presenter to analyze the elements simultaneously, highlight the differences and similarities, or give reasons for either. In case graphics are extensive enough, it also gives the audience the opportunity to draw conclusions themselves. The primary purpose and goal of the engagement pattern is to raise the audience's attention through interacting with it, making the data more engaging, while facilitating a wish for further investigation. For the engagement pattern, the usual techniques are “call to action”, “rhetorical question”, and “exploration” (Bach et al., 2018). The language used in the narrative does not necessarily need to be limited to text only. It can extend to different types of interactions, types of graphics and visual cues used, and the feedback from interacting with a visual. In their research, Segel and Heer (2010) studied different cases of narrative visualizations, highlighting both good practices as well as pointing out problematic ones. They established that taking a listener through your story can be achieved through different techniques, such as visual highlighting, animated transitions, and interactive elements. For instance, they present an example of a visualization where the elements do not dictate the order of reading, but the flow is rather accomplished through using color, size, and boldness of the elements on the visualization. In another example, visual elements like timeline sliders, progress bars, and details-on-demand (additional information shown when clicked on the icon) are used to engage the audience to interact with the visualization. Researchers also established that markers of interactivity, which clearly point out the potential for interactions with the visualization itself, were a good practice in order to facilitate engagement (Segel & Heer, 2010). McKenna et al. (2017, p. 3) built on this research and defined visual narrative flow as the correlation between the way a reader navigates the story, the visual components of the story, and the type of visual feedback the reader receives, together

with the data and facts that the author wants to communicate. In their article, they also introduced seven visual narrative flow factors, which are shaping the experience of the end user:

- Navigation output - how a reader progresses through a narrative visualization. Can be in the form of a button, slider, or scrolling input
- Level of control - how much control a reader has over story components. Can be discrete (only scrolling function), continuous (option to play through key frames and time points), or hybrid.
- Navigation process - describes the reader's position in the phases of the story. Can be represented with a text (step 1, step 2, etc.), with dots, or with a progress map, where the reader moves according to the phase of the story.
- Story layout - the type of layout model and number of columns. Three versions of a layout are a document, a slideshow, or a hybrid between the two.
- Role of visualization - examines the purpose of the visualization in regard to the entire story. Usually, text and visualizations can play an equal role, but visualization can also be a driver for the narrative, with text being used only for annotations.
- Story progression - describes the possible sequence in which the story occurs. The most common is linear, where the reader goes through each story point gradually. However, other variations like linear skip (readers jump between story points) and more complex tree structures (graphs, loops, etc.) are also possible.
- Navigation feedback - a combination of animated transitions with the animation of text and other components. Shows readers that their input has an effect on the story.

McKenna et al. (2017, p. 9) also conducted a survey to analyze whether visualizations and animated transitions contribute to higher engagement with a data story. Results of their 240-participant survey also confirmed that visualization and animation positively impact reader-perceived engagement. When talking about visual narrative flow design, McKenna et al. (2017, p.1) established two main types. One type of flow is the stepper, which is built in the form of a slideshow linear progression with a progress button. The second, scroller, is a linear progression as well, yet in a document form without a progress button. Additionally, in her work, Craig (2016, p. 12) described structural approaches, similar to stepper and scroller, naming them guided tour and scrolling story. According to Craig (2016) and McKenna et al. (2017), this type of visual narrative flow often has a progress button and allows a user to navigate through the visualization with a timeline slider for this particular case. We can also say that for this particular case, visualization is the driver of a narrative, since text boxes are mostly used for annotation and presenting additional details.

The second type of visual narrative flow is a scrolling story. It has a top-to-bottom structure and allows interactions on specific page elements. It is a very common format and usually works in

a way that new visual elements continuously load on the user's scroll. One of the advantages of scrolling stories is the intuitiveness and ease of use. There is only one navigation route, and it is very unlikely to cause any difficulties. Even though some examples may include interactive maps, visuals, or graphics, the linear path with minimal interaction from the user is not always the best case for facilitating engagement and catching attention. Additionally, Craig (2016, p. 39) discovered the third structural strategy, interactive web documentary. It incorporates graphics, video content, as well as scrolling and clicking navigation through the page to ensure the most immersive user experience, guiding a reader through a path, yet leaving enough freedom for exploration. Creating interactive web documentaries incorporating data often involves significant labor and resources, which often steers most organizations away from producing such visualizations.

4.2.3 Visualization

The next component of a data story is a visualization, which represents the data and the narrative through a form of charts, graphs, pictures, etc. Functions of data visualizations go beyond conventional presentation, as they are also useful for data analysis processes like detecting outliers, identifying trends, and checking the quality of gathered data, helping to identify the relationship between variables and see how they are distributed. To understand a visualization, one should be familiar with the context, data sources, how data was collected, the reasons for display, and how it might be interpreted by people from different backgrounds (Unwin, 2020). Thus, it is important that the person preparing the visualization also understands the context and the audience to whom the display will be addressed. In this thesis, I will be preparing a dashboard, which can be defined as a visual display of the most important information arranged on a single screen, so that the information can be monitored at a glance (Stephen, 2007).

In his work, Eckerson (2005) defines three types of dashboards, geared towards different audience types in the company: operational, tactical, and strategic. Operational dashboards put more emphasis on monitoring the processes in the company. They are mainly used by workers and supervisors, while the information gets updated on a very frequent, per-minute basis. Tactical dashboards are used by managers to compare performance, create forecasts, or budget plans. These types of dashboards are created for analytical purposes and are updated less frequently, on a weekly basis. Lastly, the goal of a strategic dashboard is to align organizational goals on all levels in order to achieve the objectives set by executives. This type of dashboard is usually updated monthly. Strategic dashboards are a powerful tool to communicate strategy, gain visibility into operations, and identify the key drivers of performance. The dashboard prepared in this master's thesis will be a mix of tactical and strategic dashboards. Being geared towards Siliko’s top management, it will allow for a quick display of performance and also be a useful forecasting tool.

Figure 8: Dashboard types according to Eckerson

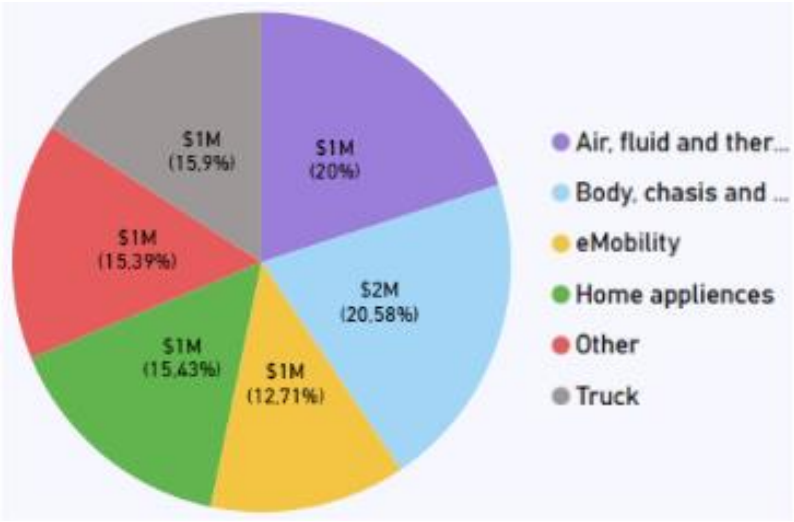
Type	Functionality	Users	Usage
Strategic dashboard	Monitor	Executives	Tracking progress (e.g., balanced scorecards)
Tactical dashboard	Analyze	Managers and analysts	Measuring and analyzing the performance. Most analytical dashboards
Operational dashboard	Detail	Front-line workers	Monitoring tracking processes

Source: Eckerson (2005).

A well-prepared dashboard should summarize large amounts of data into a meaningful visual representation. It should also allow a company or individual to speed up decision-making, track performance outcomes, and increase productivity. To achieve this, chart types used in the dashboard should quickly and concisely present the situation and potential movements. Additionally, a "template" solution to which visualization types to use does not exist: it should be tailored to the specific needs of the company, with a goal of being clear and making the most impact on the audience. The dashboard should also keep track of company-specific key performance indicators and allow for a clear display of deviations and discrepancies.

There are multiple types of techniques and visualizations available, with each being more suitable for a certain data type. In the context of sales dashboards, only a limited amount can be useful and show the data correctly without creating confusion. Pie charts are a very common type of visualization. They are useful for showing proportions of different categories in a whole. Pie charts are good for visualizing how a total is divided into different parts, e.g., showing metrics like market share, budget distributions, etc.

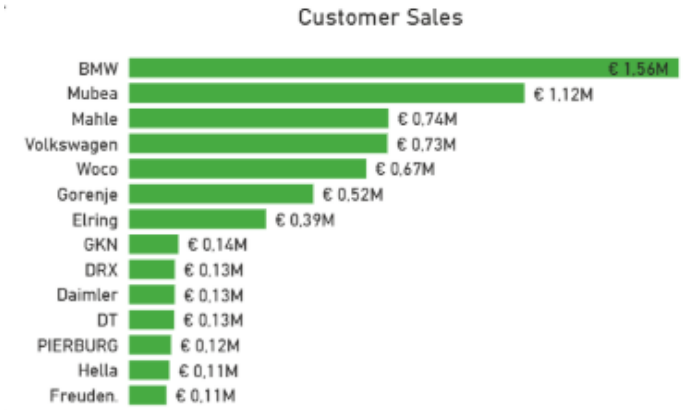
Figure 9: Example of a pie chart



Source: own work

Bar charts (or column charts in case of horizontal layout) are structured with a number of vertical or horizontal bars for each category. They contain two axes: the X axis shows values, while the Y axis shows categories. However, in some cases, one of the axes can be eliminated if the data allows for enough clarity without it. The size of each bar represents the size of the shown metric for a particular category. One significant drawback of a bar chart is its inferior ability to represent many categories at once due to overcrowding (Miller, 2019).

Figure 10: Example of a bar chart



Source: own work

Timelines are usually used to present data over a period of time. Data points are connected by a line, showing how a category value changed over a particular period of time. Line charts are good for representing trends and fluctuations. If multiple lines are added to one chart, they also allow for easy comparison between two variables.

Figure 11: Example of a timeline

Source: own work

4.2.4 Audience

Even though researchers do not widely mention it among the previous three, the audience is also an important component of data storytelling. Communicating data stories effectively requires an understanding of who your audience is, what their goals and knowledge levels are. It is an important factor to consider, since a single data story cannot be suitable for all audience groups. Different audience groups may not only have different levels of familiarity with the subject, but also have different expectations, attention spans, and preferences. Being completely familiar with your audience will, at least in theory, give the author the ability to prepare the most appealing and targeted data story. However, in practice, gaining complete knowledge of the audience is hardly ever achievable (Riche et al., 2018).

Riche et al. (2018) have identified three areas of knowledge, which might help data story authors better understand their audience. The first area is data and visualization literacy, which is the ability to observe patterns in the data and answer questions through graphs and visualizations. Understanding the level of data literacy of the audience can help authors determine whether visualizations in the data story need annotations. Annotations add explanations and descriptions to introduce the graph's context, which is important for almost any audience (Hullman et al., 2013). They can also explain how to read the graph and help understand the data more thoroughly. The second area is background knowledge and expertise. Data story authors should carefully consider the level of expertise the audience might have, as well as how the story will impact a particular audience group. For instance, niche audiences may be more comfortable with the jargon, but creators should consider removing jargon if it would serve a larger audience with less specific knowledge. Lastly, audience needs and expectations need to be considered to create an impactful visualization and subsequent data story. Data stories are more impactful and useful when created with the audience's goals in mind. They can be designed differently depending on whether the audience is expected to have a social, entertainment, or informational motivation. The same holds for visualizations: consistency across color, font, and layout should differ based on the audience's expected motivation. While brighter, more colorful, and interactive visualizations might be suitable for people looking for entertainment, a more reserved and concise approach might be better suited for an audience with informational motivation. Overall, it is important to gather as much information as possible about the target audience of the data story, since it is the baseline for making the data story as effective as possible (Drucker et al., 2018).

5 DEVELOPMENT OF POWER BI DASHBOARD

In previous paragraphs, I provided arguments that in the current business environment of the automotive industry, it is of significant importance to have the ability to monitor company performance and predict trends. The concept and benefits of data storytelling were also

presented, while the roles of all 3 components were described in detail. In this paragraph, I will now use the knowledge obtained for the development of a Power BI sales dashboard.

5.1 Overview of Siliko and the benefits of the sales dashboard for the company

Siliko d.o.o. is a supplier and manufacturer of technical products made of rubber and plastics, established in 1993. Up until today, the product portfolio has expanded substantially and nowadays includes a variety of activities and services, starting from draft design and construction to tool making and mass production. Around 70% of Siliko products are being exported to the European Union markets, predominantly to buyers from the German automotive industry, yet the company is also present in the home appliance industry, sanitary industry, medical, etc. A key to Siliko development was the fact that the company does not source tools or any types of components from third-world countries. In the past, the company's strategy was to establish itself as a "One-stop shop", which definitely had its benefits. Developing internal capabilities and keeping the knowledge in-house increased the expertise and improved employee skills on all levels in the organization. It also gave Siliko more control over the whole production process and allowed for development based on lessons learned. However, doing everything internally might not be the best strategy in all cases, and having Chinese, Turkish, or Eastern European suppliers is a very valuable asset that Siliko unfortunately does not have. As research shows, automotive suppliers are now being pressured by OEMs into decreasing part prices. My prediction is that Siliko will also be strongly pressured to decrease prices not only by OEMs, but also by its Tier 1 and Tier 2 customers. Price movements and turnover will need to be closely monitored in order to predict the company's financial performance and prevent potential losses due to price pressure. Customers are looking for cheaper production, and it is sometimes hard for Siliko to battle with the competitors, who source their molds, raw materials, and purchase components in Asia, predominantly in China. Of course, one can argue that this might result in lower quality of goods and less control over the process for Siliko, yet in some cases, where price pressure is significant, cheaper raw materials are what make a difference between being nominated for a project or not. In my opinion, not working on developing connections with suppliers from all over the globe is a huge missed opportunity and can be very problematic going forward. As described previously, the automotive industry is currently in a phase where OEM producers have the power to enforce their "rules of the game," and price is one of the key aspects they are taking into consideration. My opinion is that Siliko certainly needs to establish connections with suppliers from third countries for products like molds, metal elements (bushes, washers, etc.), and compounds. Otherwise, it is very likely to happen that for the majority of future projects, Siliko will simply not be able to compete with other players on the market.

Even though Siliko uses modern production technology in its operations, the use of modern analytical and forecasting tools to assist in decision-making processes would not be redundant, especially given the changes in the automotive industry. With EV sales numbers decreasing and customers preferring ICE vehicles, much lower sales of products related to electric platforms are to be expected in the upcoming years. For Siliko, this would mean that battery seals, venting units, and other EV-related product groups will experience a significant decline. On the other hand, Siliko has a huge portfolio of products related to petrol and diesel cars. Monitoring the sales numbers of each segment would be necessary to understand the impact of upcoming trends on the financial performance of Siliko. It is also expected that new, less developed markets for electric vehicles, like South America and greater Asia, will arise. Given that, Siliko should be on alert in case its existing customers decide to increase their market share in those regions. Monitoring all incoming inquiries and giving additional attention to those that are meant for the emerging markets can be a good strategy for Siliko in the upcoming years to widen the company's reach even further.

When it comes to data, as I mentioned previously in this master's thesis, Siliko gathers its sales data in the ERP system, which is then transformed into an online analytical processing (hereinafter OLAP) spreadsheet. Even though the data is somewhat clean and without errors, it is not user-friendly due to various reasons. The first issue is the size of the OLAP file and the subsequent slowness of any sort of data analysis there. Siliko has sales data from over 700 customers stored from 2007 onwards. These customers have hundreds of different products, and filtering down the required information takes a lot of time. This could be significantly improved by Power BI implementation. The benefit Power BI presents is that it integrates directly with the company's database, either locally or in the cloud, allowing access to the necessary data in real time. This allows to reduce data lag, improving loading times, and removing the need to work with big pivot tables with numerous variables. With Power BI, data processing is much faster, while multiple queries can be created within seconds. Power BI offers a centralized solution that gathers data from multiple sources into one dashboard, resolving the need for manual data manipulation, preventing inconsistencies, and generally improving data accessibility. Another great issue is data visibility. With the current layout in OLAP, it is very hard to compare the sales numbers among customers, years, and the trends are not visible at all.

In Siliko, sales results are monitored in weekly sales meetings. In those meetings, company management, together with sales department employees, review customer sales, open projects, accounts receivable, etc. For the purpose of reporting, sales analysis reports are specifically prepared every week by an employee, which usually takes 2-3 working days. Those reports are in the form of Excel spreadsheets and PowerPoint presentations, which look much more user-friendly compared to OLAP. However, there are other types of issues present with this reporting format. For instance, the data in the reports is always a bit outdated, as it is taken on the day of

report preparation, rather than being available in real time. Additionally, in case changes in sales performance for a particular customer occur, those are mostly not visible until the sales report is created, unless they are looked for specifically. This results in an issue where the company must then react to the week-old market changes, rather than predicting or recognizing them in the early stages. Moreover, in order to visualize a trend, every chart has to be prepared manually, which is also time-consuming. When reviewing the open projects, a manager must open a separate browser window for every pipeline he or she wants to see. Multiple windows must then stay open at the same time, each for every employee, completion status, year, etc. It is often problematic to keep track of all those windows, which consumes time and disrupts the meeting flow. Compared to OLAP spreadsheets and manual reports, Power BI offers a better selection of visualizations that are much easier to work with. Users can quickly create interactive charts that show sales patterns, customer comparisons, and other important parameters. When connected with the company ERP, Power BI reports are available in real time without any delay. The program also gives the ability to automatically show trend visualizations, highlight increases or decreases in sales across clients, goods, and years. This presents a great improvement in comparison to current reporting methods at Siliko, as it will instantly draw attention to possible discrepancies and problems. Additionally, the program allows setting alerts for specific metrics, e.g., a drop in customer sales beyond a specific level, immediately notifying the responsible person about the change. Report creation is also automated in Power BI and completely eliminates the need for manual preparation by an employee.

In essence, the user experience with OLAP and spreadsheet reports in Siliko is not satisfactory, and the ease of use is far from being sufficient. Bad user experience results in multiple problems: employees tend to miss important data due to poor data visibility, or do not monitor the reports at all, and are not informed about the company's performance. Unless looking for such information specifically, employees are unaware whether sales numbers of a particular product segment are lower in comparison to previous years, whether a customer has started to slowly decrease the order quantities for a particular product, etc. With the implementation of a Power BI sales dashboard, such metrics will be presented in a user-friendly way, and drill-down analyses will be easier to perform. Trends will become easier to track and compare across periods and customers, while real-time reporting will happen with just one click. Ultimately, with the implementation of Power BI, a company can improve data accessibility and decision-making, making it a valuable tool for improving business operations.

5.2 Dashboard design concepts

The function of the dashboard is to display intended data together with its use and purpose. Rather than providing only the visual view of the data, functional dashboards include interactive features and provide support for strategic, analytical, and operational decision-making. The

exact functionality must then be tailored to specific needs, considering the end user of a particular dashboard (Sarikaya et al., 2018).

It is also important to determine the goals of the dashboard beforehand and evaluate resources at hand, since the purpose is what makes a baseline for future development of the dashboard. Both dashboards and visual analytics (hereinafter VA) systems are decision-making tools that simplify the understanding of the data. Yet there are three main differences that distinguish the two. The first key difference is the input data: VA systems can handle raw, unprocessed data, while dashboards are created based on data that has already been cleaned and transformed. The second difference is the complexity of the analysis offered: VA systems are created for deep analysis and complex insights derivation, while dashboards only allow for surface analysis with functions like filtering, comparison, and selection. Lastly, the difference is also in user interaction, since dashboards are made for monitoring purposes, while VA systems provide a deep understanding of the topic (Conrow et al., 2023). For the dashboard prepared in this master's thesis, it would not make sense to choose visual analytics systems. The data that will be used is already cleaned and transformed, thus there will be no need for raw data. Additionally, the limited analytical functionality of the dashboard will be sufficient, since it will be mostly used as a monitoring tool for sales performance tracking. Overall, it is of significant importance to determine the purpose and the goals of your dashboard, since only based on that, relevant data and metrics can then be chosen.

The data stories I will be telling with my dashboard will be geared towards Siliko's top management and key account managers. From Figure 7, effects listed on the X axis, and my wish for the dashboard to compare results and encourage the audience to take action, I think the most appropriate narrative patterns for my case would be argumentation and engagement. In my dashboard, the argumentation pattern will be implemented through different visualization elements. For instance, a bar chart will show a comparison of sales revenue of different customers in the current year. The movement of sales revenue through time will be shown with a line chart. Lastly, a card will show the percentage difference between sales revenue in a year and the budgeted numbers. As mentioned above, in the context of the engagement pattern, the usual techniques are "call to action", "rhetorical question", and "exploration". Through the search, the users of this dashboard will be able to discover more information by clicking on the data point. For instance, by selecting a particular customer, users can see a breakdown of sales numbers per product. This allows top management to receive detailed information for only what is needed and not show excessive data that might be unnecessary. Color-coding is another tool that will be used under the Engagement pattern, as it is proven that greater engagement of working memory and attention can be achieved through color-coded data (Liu et al., 2021). Red color will be used to represent declining trends, while growth trends will be shown with green.

By incorporating these narrative patterns, the dashboard will become more than just a data visualization tool. It will function as a decision-support system, encouraging proactive business decision-making. Argumentation through comparison will enable management to highlight major differences between data points, whereas the Engagement pattern will ensure that findings are actionable and easy to investigate. This will make sales performance evaluation at Siliko's more efficient, mitigate risk identification, while also creating an environment for effective decision-making.

Choosing the right chart type for your metric is also an important thing to consider. There are a number of different chart types, and a few examples were already described in one of the previous paragraphs. Additionally, Dr. Andrew Abela (2020) created a Chart Chooser diagram for easier graphics selection based on what one wants to present. The diagram can be observed in Appendix 3. A well-prepared dashboard must provide context and tell a data story, while facilitating action to take. Thus, choosing the right chart type for your data is the baseline for a successful dashboard design. The layout of chosen chart types also has a significant impact on the quality of a dashboard and the further actions it would facilitate. A common misconception is that people tend to read web pages from left to right, yet research shows that this is not the case. Scanning through a webpage is not a random act, but rather a way people strategically gather information, shapes, or specific words from the text. It is page layout, content, and user motivation that cause these scanning patterns to emerge.

In their research, Pernice et al. (2019) describe four main web page scanning patterns: F-pattern, Layer Cake Pattern, Spotted Pattern, and Commitment Pattern. F-pattern occurs when people scan a page in a path that forms the shape of the letter “F”, and is also the most common way of scanning a web page. The user begins reading at the beginning of the left and reads to the far right. On the second line, the user again reads from left to right, but stops before hitting the rightmost point that he read on the first line. As the user progresses down the page, he reads fewer and fewer words toward the right, always returning to the left. Eventually, there comes a point when the user stops looking at the text altogether (Pernice, 2019, p. 54). In a layer cake pattern, readers scan only the headings of the paragraph and then select the one to read. Minimal information is being obtained, yet one can determine which section to ignore and which to focus on. Here, the colors, fonts, and overall visual appearance of headings play a significant role in the efficiency of the scanning process (Pernice, 2019, p. 79). Spotted pattern means that users scan the page for words, shapes, or numbers of their interest. The pattern itself can vary based on the user's motivation and may appear random, yet the designer of a web page has a significant effect on which elements will be spotted. Editors can funnel readers’ attention by bolding, headings, and other visual effects in order to ensure that the scanning pattern is similar to their desires. These elements can play a significant role when trying to tell a story with data, since readers might miss out on important information, unless presented correctly (Pernice, 2019, p.

93). As it is evident from the name itself, a commitment pattern indicates more precise and reading user's areas of interest and little to no interest in areas the user finds not interesting. Commitment patterns can emerge from the three previously mentioned patterns based on the reader's motivations. It can also happen that the page will be read completely with total commitment, yet these cases are very rare (Pernice, 2019, p. 109).

Even though patterns described above emerge based on the user's motivations and interests, it is important to consider how the user is being guided through the scanning process by using different visual elements. When telling a story with data, the reading pattern one takes becomes even more important, since the actions data storytelling is meant to facilitate will not be correct unless the narrative is communicated correctly. An exact scanning path for a user cannot be determined in advance, yet the use of visual elements allows for emphasizing specific elements that can help to route the user in the right direction. Additionally, it is good advice to structure a web page similarly to one of the above-mentioned scanning patterns.

Headings are one of the most versatile tools to attract attention in the text or graphics. No matter the pattern of how a web page is being scanned, headings will be among the first things to get noticed. It is important that headings differ from the rest of the text in terms of boldness, color, and font, while also giving context to the text or graphic. Color itself is another important tool that attracts the reader's attention. The human eye perceives color based on the surroundings, so it makes sense to use backgrounds that contrast with the object to be shown. Background color should be consistent in graphics and tables as well, thus it is advised to avoid using gradients and varying colors when showing multiple objects (Few, 2008). Using white as a background color is always a good choice. The human eye is designed to adapt color perception relative to the white, thus a white background is a stable "baseline" to focus on (Stone, 2006). Additionally, non-data components of tables and graphs should not distract the audience from the data story; thus, choosing the best color and style for each component is highly advisable. From color theory, there are three different versions of color pallets: categorical, sequential, and diverging. Categorical pallets are used to split items into separate groups, while sequential and diverging are used to show quantitative differences. When arranging quantitative values, color intensity should go from pale for low values to darker colors for high values (Few, 2008).

It is clear that using colors, headings, and fonts in a dashboard can elevate the quality of such and improve the transmission of the data story narrative. However, it is possible that using these brings more harm than good, especially when not done correctly. Different colors should be used only when there is a need to send a particular message and show the differences in the data. Excessiveness can cause distraction or even lead to a lack of understanding of the message. Simplicity is key, and less important information like gridlines, axis labels, etc., should be made less visible or eliminated completely. Charts should not be overcrowded, as too many categories

will only confuse the audience and make the data hard to understand. Additionally, visual elements like 3D and shadows should not be used at all, since they can distort the audience's perception of size and might lead to drawing wrong conclusions about the data story (Zoss, 2014).

5.3 Dashboard creation and programming

The main goal of the sales dashboard creation for Siliko d.o.o. is to present company results and transform them into actionable insights for future decision-making. The idea is to provide decision makers (company management) with an interactive visual environment for analysis of complex and bulky sales data in spreadsheets. This is also in line with the broader objective of this thesis: using data storytelling techniques to reduce the gap between raw data and strategic actions, while also reducing the lead time needed for the decision-making process. The creation of the dashboard is a multistep process, where I first must determine the user needs, select and prepare the data, define key metrics, and create the dashboard itself. Optimization and validation through usage are planned in the further steps, after actual testing in a working environment.

Since one of the main goals of this project is to create an intuitive environment for predictive, rather than reactive decision-making in Siliko, I decided to base my dashboard creation on the Problem - Insight - Action framework for data storytelling, with subsequent goals:

- Problem - identify market trends, performance gaps, and lagging results in the early stages.
- Insight - compare trends in sales, customer performance, and new project pipelines to historical data and derive insights. Reveal deeper growth/decline signals and determine the root cause.
- Action - provide decision-making cues and focus effort on performance optimization not only in the sales department, but in the whole company (Lakshmi, 2025).

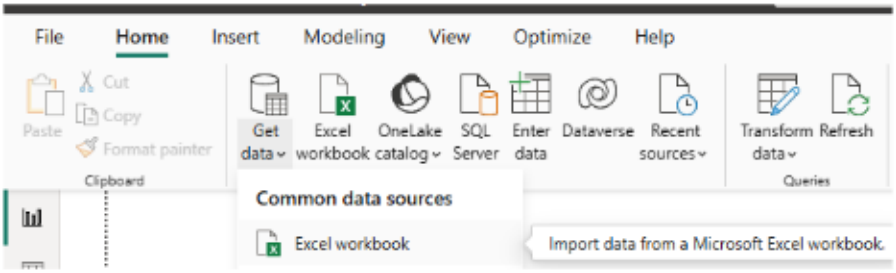
Before starting with the development itself, a series of discussions and workflow analysis was performed to determine the requirements the dashboard needs to possess. Based on the data monitored by management, as well as employees in the sales department, it is clear that the functionality should be built around providing users with a view of the company's current state, highlighting the indicators of potential revenue shifts in the future, and guiding user focus to specific areas. This led me to create three separate pages on my dashboard, each having a specific purpose:

- Company view - provides a “bigger picture” about company performance as a whole, presents macro-level analysis of sales results, market segments split, and sales trends.

- Project view - provides information on current requests for quotation (hereinafter RFQ) success and focuses on future revenue streams for Siliko.
- Customer view - provides a detailed analysis of a specific customer or product, while highlighting important discrepancies and driving action.

When starting the actual dashboard design process, the first step is to prepare data. As mentioned previously in this thesis, Siliko's sales data was gathered in an OLAP spreadsheet, which made analysis of such data very inconvenient and time-consuming. Data analysis and insight derivation from such data is very difficult, since it is not presented in a user-friendly way. Comparing current results to historic data requires a lot of clicking. The differences between data points are not shown and require manual calculation. Overall, I think that the visual appearance of the spreadsheet is not very appealing, while also limiting the functionality and readability I strive to achieve with my dashboard. The above-mentioned spreadsheet is also the main data source for my dashboard. However, through multiple steps of data manipulation and structuring, I created seven separate tables with columns for easier manipulation and the architecture of my model. The list of tables used in the dashboard is shown in Appendix 2. The next step is to upload the data into Power BI. In the Home tab, select "Get Data" and choose the data source. Since I have my tables in Excel, I should select "Excel workbook" and upload all the files into Power BI.

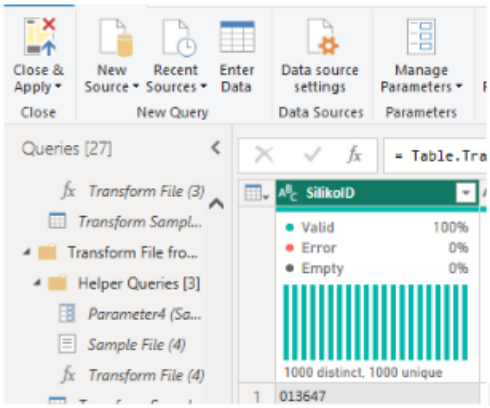
Figure 13: Data upload into Power BI



Source: own work

After the data is uploaded, the Query editor will open, where all data transformation and formatting happens. In this step, I remove the duplicates from my data, rename columns, merge and append queries, etc., for easier and cleaner data for my model. Under the column name, there is a short visualization of my data "health", which shows whether my data contains errors, empty rows, and duplicate values. After I am satisfied with the data, I click "Close & Apply" to proceed to model creation.

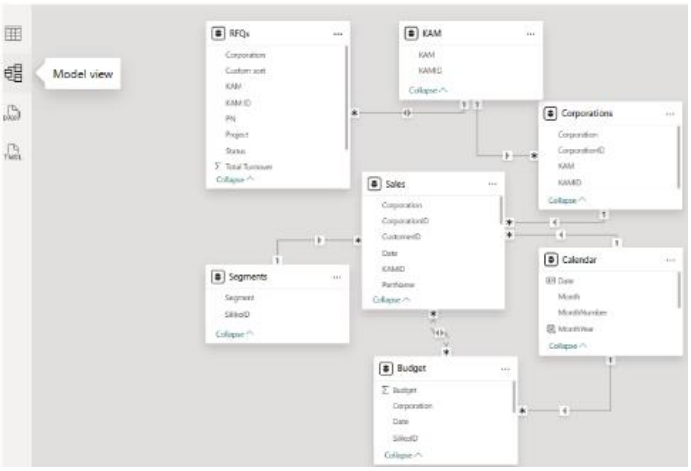
Figure 14: Power BI query editor



Source: own work

After the data transformation, the next step is to connect the tables. The tables are connected in the "Model view" on the left side of the screen. I do it by using unique identifiers (unique categories like employee identification number, invoice number, etc.), which resulted in a layout as shown in Figure 15.

Figure 15: Dashboard model layout



Source: own work

The success of a dashboard is highly dependent on the particular key performance indicator (hereinafter KPI) chosen and calculated. When trying to identify what KPIs should be presented on my dashboard, I decided to base my decision on user needs in Siliko and the metrics monitored in sales review meetings. Since I am preparing a sales dashboard, most of the KPIs will be of a financial nature, predominantly related to turnover, and its comparison to other metrics. Each page of the dashboard has a different set of metrics, used to present information relevant to that particular view, as described above. For instance, in the Company view, the dashboard shows a comparison of total sales with budget, monthly sales compared to the

previous month and to the same time last year, sales by customer, and sales by product segment. It is the most important financial indicator, which allows management to track overall revenue generation while helping to assess the financial stability and growth of the company. Additionally, a filter for year and month will enable switching between different time periods. Through comparison of current revenue with historical data, management is able to identify opportunities and threats in the market.

The Project view is focused on the project pipeline and will show the total number of RFQs and their distribution across status categories, project ranking by turnover, and a filter by key account manager. This allows top management to analyze the performance and efficiency of each key account manager, while also determining the reasons for rejections and gathering insights for the future. It is also beneficial for improving the offering approach where it is needed and refining sales strategies to win more business.

Finally, in the Customer view, the dashboard shows sales per corporation, sales per part number, last month's sales with percentage changes, year-to-year growth with percentage change, and budget with a percentage change to actual sales results. By monitoring this KPI, Siliko is able to evaluate the accuracy of the sales forecasts and improve future demand planning.

To tell a story with data, one must not only list the numbers but also use appropriate visualizations for specific data and messages conveyed. With the help of the Chart Chooser diagram from paragraph 5.2. and the message KPI has behind it, the correct visualizations are selected in order to allow for easier insight derivation. For example, the pie chart is selected to present Total sales by segment KPI, as it is the most suitable diagram for showing a share of a total (in this case, total sales in Siliko). Another example is that the line chart is used to show how the total sales in Siliko changed over time. The overview of all metrics and corresponding visualizations is shown in Table 2.

Table 2: Key metrics for the dashboard

Name of the KPI	**What does it show**	**How will it be presented**
Total sales	Price times quantity of all products sold	Card visualization Table Line chart
Total sales compared to budget	Price times quantity of all products sold compared to budgeted sales	Card visualization Table
Total sales by segment	Price times quantity of products in a segment	Pie chart
Total sales by customer	Price times quantity of products of a customer	Bar chart Table
Total RFQs	Projects in Siliko pipeline	Donut chart
Total RFQs by KAM	Projects in the pipeline for each KAM	Donut chart
Project ranking by turnover	Projects in Siliko pipeline	Table
Budget by corporation and Siliko ID	Budgeted sales of particular customer and part number	Table

Source: own work

5.3.1 Creating the Company view

The Company view shows a set of different carts and card visualizations, each representing a specific metric. It contains 3 cards: the first one for total sales compared to budgeted sales, the second for total sales in a month compared to the previous month's results, and the third one to compare this month's sales to the same month in the previous year. This type of arrangement allows users to compare numbers effectively and see the differences, both nominal and percentage, without additional calculation. In order to bring sales data into a visualization, measures using Data Analysis Expressions (hereinafter DAX) should be created to present each KPI. The most important measure for the card visualizations in this dashboard is “Total sales”. Following the “Total sales” measure, I created the rest of the measures to show the data on my card visuals. The syntax for each measure is presented in Figure 16.

Figure 16: Measures on card visuals

```
Total Budget =
SUMX(
    FILTER(
        'Budget',
        NOT(ISBLANK('Budget'[SilikoID]))
    ),
    'Budget'[Budget]
```

```
Card Budget Delta =
VAR ts_bg=[Total Sales]-[Total Budget]
VAR ts_bg_pct=DIVIDE([Total Sales], [Total Budget]) - 1
VAR sign=IF(ts_bg > 0, "+", "")
RETURN
    sign & FORMAT(ts_bg_pct, "#0.0%") & " | " & sign & FORMAT(ts_bg, "#0,#")
```

```
Total Sales (prev month) = CALCULATE([Total Sales], PREVIOUSMONTH('Calendar'[Date]))
```

```
Card Month Delta =
VAR ms_lm=[Total Sales]-[Total Sales (prev month)]
VAR ms_lm_pct=DIVIDE([Total Sales], [Total Sales (prev month)]) - 1
VAR sign=IF(ms_lm > 0, "+", "")
RETURN
    sign & FORMAT(ms_lm_pct, "#0.0%") & " | " & sign & FORMAT(ms_lm, "#0,#")
```

```
Total Sales Same Time Last Year = CALCULATE([Total Sales],SAMEPERIODLASTYEAR('Calendar'[Date]))
```

```
Card STLY Delta =
VAR ms_stly=[Total Sales]-[Total Sales Same Time Last Year]
VAR ms_stly_pct=DIVIDE([Total Sales], [Total Sales Same Time Last Year]) - 1
VAR sign=IF(ms_stly > 0, "+", "")
RETURN
    sign & FORMAT(ms_stly_pct, "#0.0%") & " | " & sign & FORMAT(ms_stly, "#0,#")
```

Source: own work

Color coding is a design principle that is meaningfully used in this dashboard in order to allow users to see the distinctions between data immediately and drive the narrative. In the Company view, the red color shows decreases, while green shows positive and exceeding values. In order to achieve that, I created a color measure for each card and wrote the criteria for what should be colored red and what green. I wanted the green to the Siliko green color with a HEX code #47AB42. Figure 17 shows the syntax, which is similar in all 3 cards, the only change being the variable (VAR) it calculates. In order to implement the color coding on a card, the measure created should be selected as a color for the "Callout value" of the card.

Figure 17: Measure for color-coded differences in the Company view

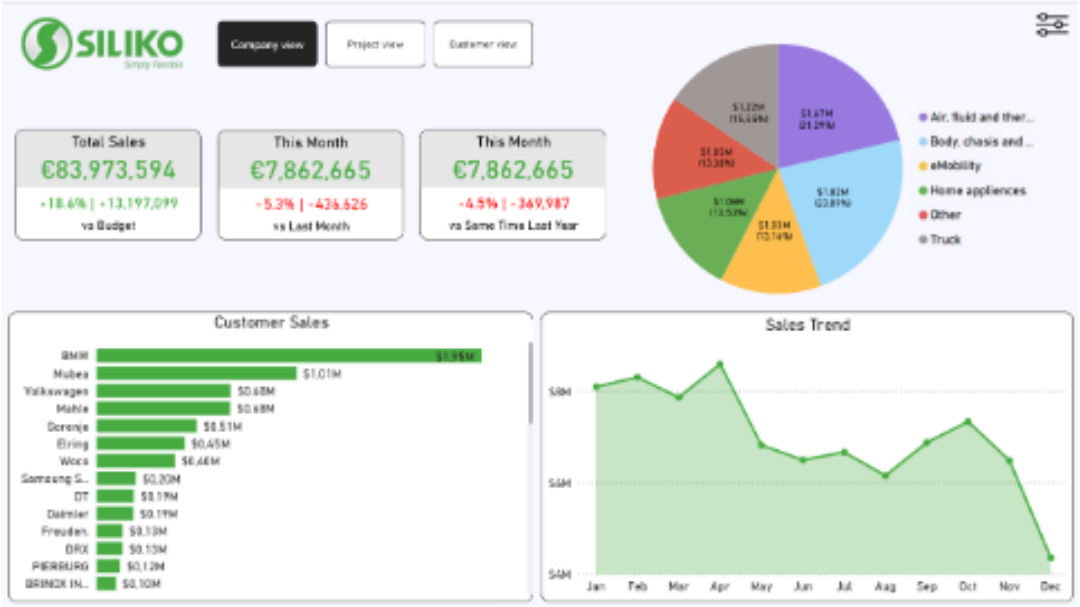
```
Card STLY Delta =
VAR ms_stly=[Total Sales]-[Total Sales Same Time Last Year]
VAR ms_stly_pct=DIVIDE([Total Sales], [Total Sales Same Time Last Year]) - 1
VAR sign=IF(ms_stly > 0, "+", "")
RETURN
    sign & FORMAT(ms_stly_pct, "#0.0%") & " | " & sign & FORMAT(ms_stly, "#0,#")
```

Source: own work

The company view also contains three other visualizations: a bar chart, a line chart, and a pie chart. For the bar chart, "Total sales" is selected for the X axis, while "Corporation" is selected

for the Y axis. For the line chart, however, “Total sales” is put on the Y axis, while “Month” from the “Calendar” table is put on the X axis. For the pie chart, “Total sales” is the value, while “Segment” is the legend. Lastly, a filter pane with a selection of slicers was created to allow for switching between different time periods, customers, products, etc. The final look of the Company view is shown in Figure 18.

Figure 18: Company view



Source: own work

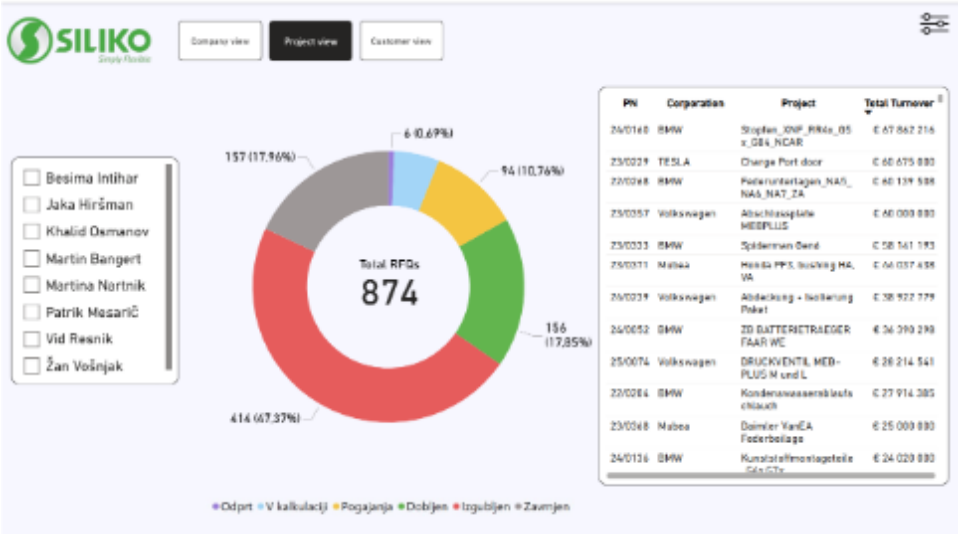
Through a combination of selected visualizations and measures, Company View provides a quick overview of Siliko’s sales results for a selected period. The three cards present the important comparison of sales turnover to past results at a glance. The pie chart shows the performance of each product segment in the company, while the line chart presents the movement of the revenue throughout the year. Lastly, the bar chart dissects the data one step further, giving us an overview of each customer’s performance. The layout of the dashboard also plays a significant part in improving its readability. The whole dashboard was created with spotted and commitment patterns in mind, as different shapes and colors are used to attract users’ attention and facilitate deeper analysis. Here in the Company view, the shaped cards and colored numbers will attract the user to acknowledge the shown data, and facilitate further analysis and drill down.

5.3.2 Creating the Project view

As mentioned previously in this thesis, the purpose of the project view is to provide an overview of the past and current projects in the Siliko pipeline, while allowing for individual KAM performance assessment. This view contains two tables and a donut chart. The first table is, in fact, a slicer with the name of each KAM. In the middle, a donut chart shows the total number

of projects and the share for each of the six different statuses. Lastly, on the right-hand side, there is a table which shows the project information like name, corporation, and turnover. In the Project view, different colors are used for different success statuses of the project: green for won projects, red for lost projects, yellow for projects in negotiation, etc. Lastly, the date slicer allows users to select the year and monitor previously acquired projects. The layout of the Project view is geared towards the commitment reading pattern, meaning that on the left, you commit to choosing a KAM, and when progressing forward to the right, you see the results of this particular KAM and project specifics.

Figure 19: Project view

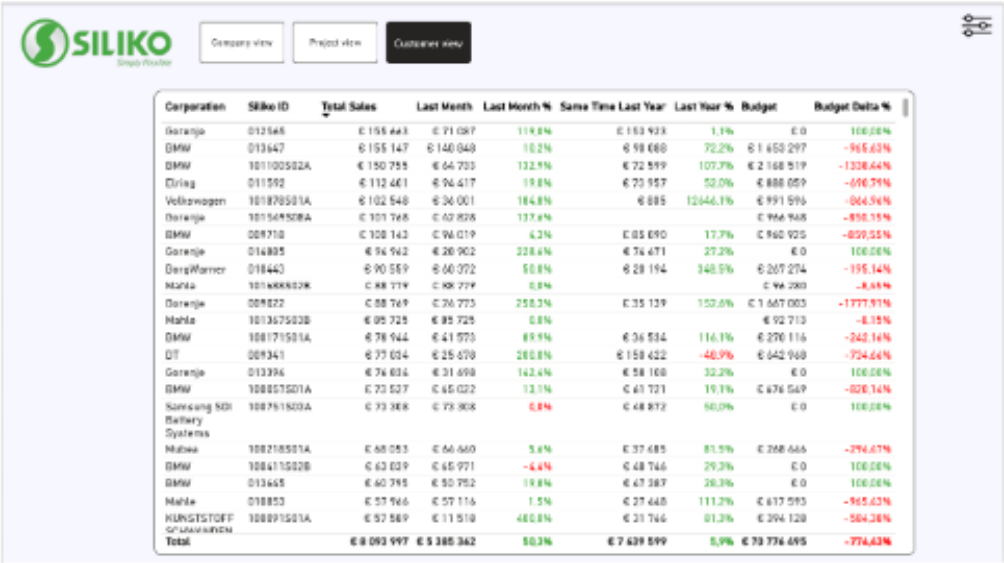


Source: own work

5.3.3 Creating the Customer view

In order to have an option for a more detailed analysis of a particular customer and the products Siliko produces, it decided to create another page in my dashboard called Customer view. The main visualization here is the table, which contains the data about each product's performance. The search filter by corporation and part number (SilikoID) in the filter pane gives the ability to obtain the data for a particular customer and product immediately. The layout of the view is shown in Figure 20.

Figure 20: Customer view



Corporation	Siliko ID	Total Sales	Last Month	Last Month %	Same Time Last Year	Last Year %	Budget	Budget Delta %
Gorenje	012565	€ 155 443	€ 71 087	118.8%	€ 153 933	1.1%	€ 0	100.00%
BMW	013647	€ 155 147	€ 140 048	10.2%	€ 90 080	72.2%	€ 1 650 297	-965.63%
BMW	101100502A	€ 150 755	€ 64 703	132.9%	€ 72 599	107.7%	€ 2 168 519	-1338.44%
Elring	011592	€ 112 461	€ 94 417	19.8%	€ 73 157	53.8%	€ 888 059	-690.31%
Volkswagen	101870501A	€ 102 548	€ 36 001	184.8%	€ 885	12446.1%	€ 991 596	-866.96%
Gorenje	1015695208A	€ 101 768	€ 42 826	137.6%			€ 966 968	-850.35%
BMW	009710	€ 100 143	€ 96 019	4.3%	€ 85 690	17.3%	€ 960 925	-859.55%
Gorenje	014805	€ 96 962	€ 20 902	228.6%	€ 74 471	27.2%	€ 0	100.00%
BorgWarner	018443	€ 90 559	€ 60 372	50.8%	€ 20 194	348.5%	€ 267 274	-195.14%
Mahle	1014006502K	€ 88 779	€ 88 779	0.0%			€ 96 280	-8.44%
Gorenje	009822	€ 88 769	€ 24 775	258.3%	€ 35 139	152.6%	€ 1 667 003	-1777.91%
Mahle	1013675020	€ 85 725	€ 85 725	0.0%			€ 92 713	-8.15%
BMW	1081715014	€ 78 944	€ 41 573	89.9%	€ 36 534	116.1%	€ 270 116	-242.14%
DT	009341	€ 77 034	€ 25 678	200.0%	€ 158 422	-48.9%	€ 642 968	-734.64%
Gorenje	013396	€ 76 036	€ 31 698	142.6%	€ 58 100	32.2%	€ 0	100.00%
BMW	1088515014	€ 73 527	€ 65 022	13.1%	€ 61 721	19.1%	€ 676 569	-820.14%
Samsung SDI Battery Systems	1087515034	€ 73 308	€ 73 308	0.0%	€ 48 872	50.0%	€ 0	100.00%
Mubea	1082185014	€ 68 053	€ 66 660	2.1%	€ 37 685	80.6%	€ 268 666	-294.67%
BMW	1086115020	€ 63 039	€ 65 971	-4.4%	€ 48 746	29.3%	€ 0	100.00%
BMW	013655	€ 60 795	€ 50 752	19.8%	€ 47 387	28.3%	€ 0	100.00%
Mahle	010853	€ 57 946	€ 57 116	1.5%	€ 27 448	111.2%	€ 617 595	-965.63%
KUNSTSTOFF SCHAUMWERK	1088915014	€ 57 589	€ 11 510	400.0%	€ 31 746	81.3%	€ 394 120	-584.28%
Total		€ 8 093 997	€ 5 385 362	50.3%	€ 7 639 599	5.9%	€ 73 776 695	-774.63%

Source: own work

Similar to the Company view, color coding was used to highlight the differences, attract the user's attention, and drive the narrative. In the table, decreases are shown in red, while green highlights increases. In order to achieve that, color measures have to be created. Similarly to the first view, I created a color measure for each column I wanted highlighted. The syntax for the measure to color-code the difference in sales compared to the last month is shown in Figure 21. In the case of last year's delta, the measure is the same, only the logical test needs to be adjusted.

Figure 21: Measure for color-coding "Last Month %" in Customer view

```
MoM Sales Delta % =
    var this_month=[Total Sales]
    var prev_month=[Total Sales (prev month)]
RETURN
    DIVIDE(this_month-prev_month, prev_month)
```

```
HGH Last month = IF([MoM Sales Delta %]>0, "#47AB42","Red")
```

Source: own work

To implement color coding on a card, the measure created should again be selected as the color for the "Callout value" of the card.

Two critical columns in the table are "Budget", which shows the budgeted sales value for each product, and "Budget Delta %", which shows the percentage change from the budgeted number. At the beginning of the year, each product in Siliko received a budgeted, planned sales number. This is then monitored throughout the year, analyzing the performance of each product and taking actions based on the results. The syntax for the measure is presented in Figure 22.

Figure 22: Measure "Budget Delta %"

```
MoM Sales Delta % =
    var this_month=[Total Sales]
    var prev_month=[Total Sales (prev month)]
RETURN
    DIVIDE(this_month-prev_month, prev_month)
```

```
HGH Last month = IF([MoM Sales Delta %]>0, "#47AB42","Red")
```

Source: own work

"Budget Delta %" is an important metric, since it not only concerns the sales department and financial health, but is also important for production planning, logistics, purchasing, etc. Based on this metric, Siliko is then able to adequately plan human resources for production, purchase material, and plan order dispatches to follow lean manufacturing principles and ensure organizational health across all departments.

5.4 What should companies consider before developing a sales dashboard

To turn raw data into meaningful insights through data storytelling in a sales dashboard, a combination of data analysis, narrative structuring, and visual design is needed. Making sure sales employees and executives can rapidly understand the data, make wise decisions, and produce significant results from actions taken is the primary aim of a successful sales dashboard. Understanding the main goals of the company, choosing the appropriate data and KPIs, telling a story, and providing insights through understandable visuals are all needed to create an effective sales dashboard. Understanding the business objectives of a company and the reasons behind them is the first step in creating an effective sales dashboard: what are the core goals of monitoring, which metrics will be monitored, what is the time period for a dashboard, etc. These objectives will dictate what to prioritize in the dashboard. For example, a company aiming to increase its customer base may focus on metrics like lead generation, conversion rates, and customer acquisition costs. On the other hand, a company prioritizing its financial performance will need to track the sales revenue, fluctuations, employee performance, etc.

Additionally, creators must understand the audience, since it is a prerequisite to creating an effective data storytelling sales dashboard. Sales dashboards might serve multiple users, and each of them might differ in terms of their goals. Subsequently, authors should tailor different narrative structures and data story presentations to the specific audience, ensuring the dashboard remains relevant and, most importantly, actionable.

The success of any sales dashboard is dependent on selecting the right metrics for presentation. The aim should be to focus on key performance indicators that provide actionable insights, rather than overloading the dashboard with all data available. In addition to these metrics, it's

also helpful to track indicators that signal future performance, both positive and negative. Balancing both types of indicators enables us to predict future demand fluctuations and a company's financial performance. In the process of dashboard development, companies should base the metrics on well-prepared data, as this is the core of an effective data story and will determine the quality of the narrative, visualizations, and the subsequent persuasion effect on the audience. When creating a data story narrative, companies should do so with an audience goal and desired message in mind, since narrative structure can vary based on these variables. Moreover, all seven narrative flow factors from paragraph 4.2.2 should be considered, as these are the elements that determine the user's engagement with the dashboard and data story.

Data visualizations are central to any effective dashboard. However, creators should first decide what kind of dashboard they would like to have: operational, tactical, or strategic. The choice of visualizations should match the type of dashboard and the data creators want represented. Thus, the Chart Chooser diagram from paragraph 5.2 is a tool that might be very helpful in the process. The page layout should be similar to one of the four scanning patterns in order to facilitate higher audience attentiveness. When talking about visualizations, clarity is one of the most important factors for companies to consider. Ensuring that charts are labeled clearly, colors are consistent, and unnecessary design elements like 3D effects are avoided is key to an effective visual message delivery. Simplifying the visual presentation helps users focus on the data itself, rather than trying to interpret the chart. It is important to prioritize readability and usability, making sure the dashboard is accessible. Despite simplicity, the visual appeal and level of audience engagement that visualization creates need to be considered in dashboard preparation. Research shows that including interactive elements in your visualization facilitates higher audience engagement, so it is advised to allow users at least some level of interaction with the dashboard.

The practical implementation of the sales dashboard, described in this thesis with the example of Siliko d.o.o., creates valuable operational improvements in modern organizations. The move from a manual, spreadsheet-based reporting to an automated dashboard facilitates significant changes in key working areas, improving the way the organizations interact with the available sales data. First, the most immediate impact can be observed on the working efficiency. Manual reporting requires substantial man-hours for tasks like data aggregation, data cleaning, data visualization, etc., which are now fully automated through the use of Power BI. This allows organizations to free up previously unavailable resources, allowing employees to focus on tasks of higher value. Automated data refresh from source systems such as ERP guarantees instantaneous report generation, relieving employees of monotonous data preparation activities and allowing them to devote more time to data analysis, interpretation, and strategic thinking. Moreover, a unified dashboard eliminates the inefficiencies associated with handling multiple files and systems, improving the workflow and enhancing focus in meetings.

The improvement in decision-making quality is another major upgrade that comes from the use of business intelligence. Switching from static reports to dynamic, real-time dashboards resolves the problem of data latency, allowing management to review up-to-date numbers rather than a week-old status. Incorporating visualizations that highlight shifts, outliers, and discrepancies ensures that companies can now predict trends, take preventive action, and not react to what has already happened. The correct alert thresholds for key performance indicators guarantee that anomalies are reported instantly, allowing for even more rapid intervention from employees and management.

Lastly, the implementation of the dashboard facilitates a cultural change within the organization. A well-designed dashboard, which incorporates data storytelling, improves data accessibility and spreads its usage in the company. By presenting data in a user-friendly way, it allows employees to easily address operational challenges by finding data-based answers to everyday questions. This reduces the possibility that important information will be missed, reduces the number of potential mistakes, and facilitates evidence-based decision-making.

6 CONCLUSION

This master's thesis has presented a complete overview of how important business intelligence tools are in today’s disruptive business environment, with the example of Slovenian automotive supplier Siliko d.o.o. The automotive industry continues to experience disruptions coming from electrification, shifts in consumer preferences, global political tensions, and realignments in post-pandemic supply chains. The Chinese automotive industry's entry into the global and particularly European markets presents competitive opportunities along with partnership possibilities for more responsive suppliers. Siliko can risk stagnation if it cannot adapt and respond to business intelligence trends and address the present challenges. Moreover, the adoption of electric vehicles is an ongoing, yet uneven transition that requires adaptation in the business strategy of every company. The stay of internal combustion engines, driven by infrastructure limitations and consumer resistance due to various factors, suggests the transition will be prolonged further than initially anticipated. As described in this thesis, the above-mentioned trends pose both challenges and opportunities for Siliko. The company should monitor sales performance and anticipate market shifts by transforming raw sales data with the use of business intelligence tools, which would significantly improve the workflow and agility of decision-making. The Power BI dashboard, tailored specifically to Siliko’s needs, provides an applicable solution on how those challenges can be predicted and available opportunities captured. This dashboard gives Siliko the ability to easily analyze raw sales data, monitor performance, and predict future trends. By implementing design concepts and data storytelling techniques into the dashboard, I was able to create an effective and easy-to-use tool for all stakeholders in the company, where insight can be derived within minutes, and manual report

preparation is eliminated. Through meticulous choice of metrics, split of data views, and concise visualizations, I was able to prevent data overload while also keeping the dashboard readable and informative. The key performance indicators presented in the dashboard will be useful for monitoring turnover, RFQ success rates, and industry trends that will definitely be essential for sustaining profitability under price pressures from the market. This thesis highlights the fact that in these disruptive times, making decisions based on data is essential. By utilizing the strategies and dashboard created, Siliko can turn industry obstacles into competitive strengths, ensure resilience and expansion in the changing automotive environment.

To conclude, this thesis presents a practical example of how business intelligence tools, specifically Power BI, improve the business operations of modern organizations. Data analysis no longer requires time-consuming preparations and deep knowledge, but is rather accessible and comprehensible for stakeholders on all organizational levels. The next step for this project is to involve Siliko's management team. Through practical testing and refining based on operational feedback, I plan to enhance its effectiveness to cater to more specific needs. After the dashboard is further improved and adjusted, I plan to fully integrate it with the company's ERP system, allowing for fully automated data gathering and monitoring in real time. The idea is also to create subsequent dashboards for other departments in Siliko (e.g., purchasing, logistics, and production) to spread the wide use of dashboards for data visualization and decision-making across the whole company.

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APPENDICES

Appendix 1: Global EV adoption trends overview

Region	Global market share (2023)	Key points	Barriers	Take away for Siliko
China	60%	Heavy subsidies "Made in China 2025" policy	Overcapacity risks EU/US tariffs	Opportunity to supply components for Chinese OEMs expanding to the EU. Risk of price competition.
EU	25%	Green Deal (30M EVs by 2030) France: 27% purchase subsidies	Lagging infrastructure	Focus on ICE-EV components Monitor the market
USA	10%	Tesla dominance	Protectionism	Limited impact Prioritize EU markets.
South America	<5%	Low consumer income Oil dependency	No charging infrastructure Reliance on ICE	Low priority
Southeast Asia	<5%	Low consumer income	Affordability	Opportunity if Chinese OEMs localize production to Europe
Africa	<1%	Renewable energy potential	Reliance on used ICE imports Minimal charging infrastructure Low purchasing power	Low priority

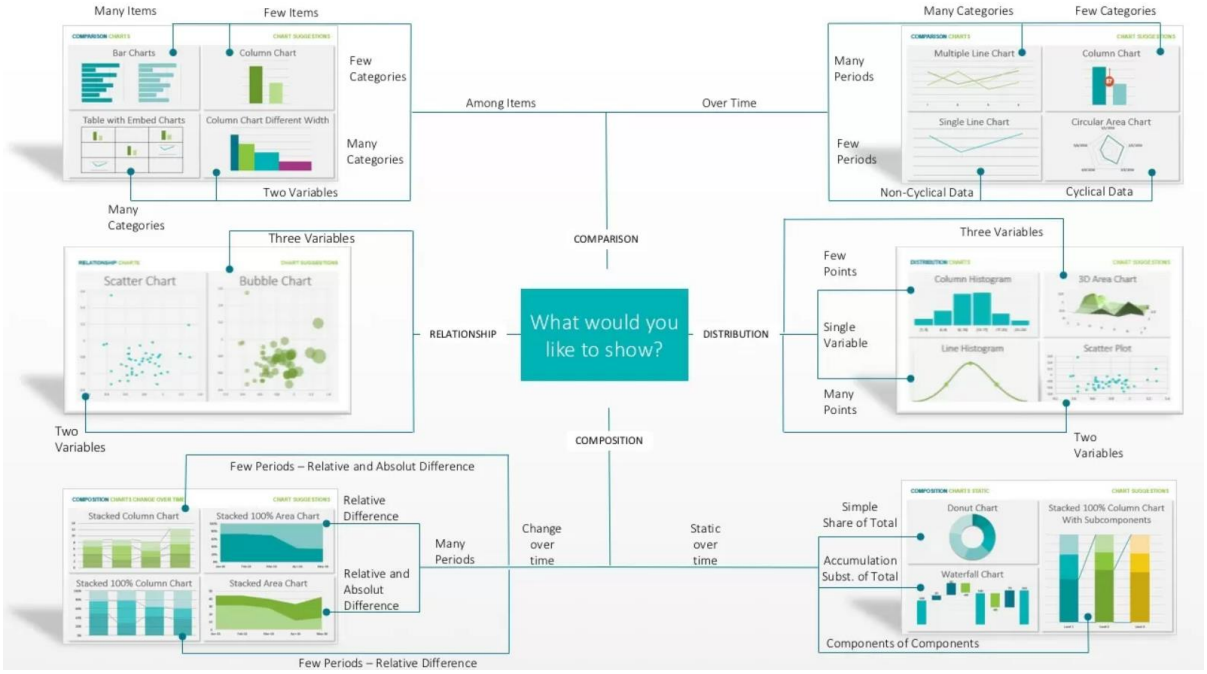
Source: own work

Appendix 2: Tables used in the dashboard model

Table name	Columns in the table	Table content
Budget	Corporation; SilikoID; Date; Budget	Shows yearly budget for each customer at Siliko
Calendar	Date; Month; Year; MonthNumber; MonthYear; StartMonth; StartYear	Calendar table for filtering data by date
Corporations	Corporation; CorporationID; KAM; KAMID	Shows corporations with their responsible KAM
KAM	KAMID; KAM	Shows the name of KAM and his/her ID
RFQs	PN; Corporation; Project; Total Turnover; Status; KAM; KAMID; Year; Custom sort	Shows the data about RFQs in Siliko
Sales	SilikoID; PartName; CustomerID; Corporation; Date; Sales CorporationID: KAMID	Shows the sales results for each customer
Segments	Segment; SilikoID	Shows segments for each part number in Siliko

Source: own work

Appendix 3: Chart Chooser diagram



Source: Abela (2020).