

POLITECNICO DI TORINO
Department of Management and Production Engineering



Application of data science and visualization for making interactive dashboards in market research

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Summary

Market research should look for tools that encourage intuitive and spontaneous reporting. Long-term operational intelligence may be enhanced by implementing interactive dashboards that are simple to set up both with and without coding. Given the numerous benefits of implementing interactive dashboards, there is still a gap and opportunity to enable the business to make intelligent decisions. In this context, vast varieties of applications and tools can be customized for businesses and companies. The aim of the thesis is to first turn easy dashboards into interactive ones by coding and without coding in a customized platform just to analyze and visualize the information. Then, it has been developed to transform the data into information by cleaning, merging, and preprocessing datasets and then visualizing it in charts and graphs consistently in an integral platform.

Keywords: a data-driven decision-making strategy, Business intelligence analysis, KPI indicators, Data analysis, interactive dashboards

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Acronyms

AI	Artificial Intelligence
BI	Business Intelligence
NPS	Net Promotes Score
KPI	Key Performance Indicator
ETL	Extract, Transform, and Load

Chapter 1: Data analysis in visual dashboards



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1- Introduction

Many businesses and government agencies now employ complex database systems to collect and manage information. A large number of data records are frequently gathered in a short period of time. These data include valuable information that may be used to find intriguing knowledge and greatly aid in decision-making. Humans, on the other hand, are incapable of comprehending large amounts of data with several properties. The necessity for automated information extraction is generally acknowledged, which has resulted in a fast-growing industry for data analysis and knowledge discovery technologies.

Despite numerous advances in the field of knowledge discovery and data mining, the human eye-brain system remains the best existing pattern recognition device for information extraction, and human analysis and insight remain the most important ways to interpret and utilize the knowledge obtained from automated data mining tools. Data visualization converts data into direct perspectives and is critical in knowledge discovery. Data visualization is a fast-growing study field, with approaches ranging from basic histogram representations to huge 3D visual reality systems. [1], [2]

Data Analytics results can play a major role in corporate decision-making allowing companies to achieve a competitive advantage and make improved decisions. Data-Driven Decision-Making is a strategy where decisions are made based on what you think is the best choice. By implementing data analytics, information is gathered to analyze trends and make decisions for the future. Everything is based on what has worked in the past, not on feelings, opinions, or experiences. markets that practice data focus their work on data. Information is the core of such companies. But to get real value, it must be accurate and fit for purpose. A data-driven approach will help you respond quickly to market challenges. It will help companies make decisions based on real numbers and predict outcomes in different areas of the business with greater accuracy. It is the kind of tool needed to drive growth, conquer the competition, and attract loyal customers or net promote scores. So, if it can use data to prove that the decisions making can directly impact business growth, it is worth taking the time to analyze it.

1-1- Business intelligence

BI reveals insights for making strategic decisions. Business intelligence tools analyze historical and current data and present findings in intuitive visual charts and graphs. Business intelligence

uses four main phases to convert raw data into understandable insights for every employee in the firm. Setting the groundwork for the final decision-making phase were the first three data collecting, processing, and visualization steps. Businesses had to perform a lot of their analysis manually before embracing BI, but BI technologies automate many of the procedures, saving firms time and money. [2]

1-1-1- Step 1: Collect and transform raw data from multiple sources and datasets into information

The extract, convert, and load approach is frequently used by business intelligence products to combine structured and unstructured data from many sources. Before being saved in a central place, this data is then processed and renovated so that applications may quickly evaluate it as a single complete raw dataset. [4]

1-1-2- Step 2: Uncover trends and inconsistencies

Automation is frequently used in data mining to swiftly evaluate data to uncover patterns and outliers that offer insight into the status of business today. BI solutions frequently include several forms of data modeling and analytics to investigate data, identify trends, and offer advice.

1-1-3- Step 3: Use data visualization to present findings

Data visualizations are used in business intelligence reporting to make results simpler to grasp and disseminate. Interactive data dashboards, charts, graphs, and maps are some of the reporting techniques that let people see what is happening in the company right now.

1-1-4- Step 4: Act on insights in real-time

Companies may take swift action after gaining insights by viewing recent and historical data in relation to company activity. Real-time adjustments and long-term strategy changes that address supplier concerns, address customer issues, address market movements, and reduce inefficiencies are made possible by business intelligence. Business intelligence technologies are helpful in enhancing firms by decreasing inefficiencies and possible problems, uncovering new income streams, and identifying areas of future development since they accelerate information processing. Many of the more specific advantages that firms receive from BI include:

- Increased efficiency of operational processes.
- Insight into customer behavior and shopping patterns.

- Accurate tracking of sales, marketing, and financial performance.
- Clear benchmarks based on historical and current data.
- Instant alerts about data anomalies and fraud detection.
- Analyses that can be shared in real-time across departments.

It appears that over the past few years, companies' investments in BI have been paying off. According to the 2022 Wisdom of Crowds® report [3], top BI achievements are mirroring top goals within organizations. Depending on the individual objectives of each company, realizing these goals can translate to a substantial ROI. This success rate will likely only continue to improve as businesses gain a better understanding of the obstacles and challenges disrupting their current BI strategies. As far as what these goals look like, better decision-making is by far the most popular target for 2022, having been rated as critical by 52% of businesses. Following that, the next top three goals for 2022 are increased competitive advantage (rated as critical by 37% of organizations), growth in revenues (37% of organizations), and improved operational efficiency/cost savings (33% of organizations). Most companies are simply hoping to improve ROI and streamline how they run their business. [5]

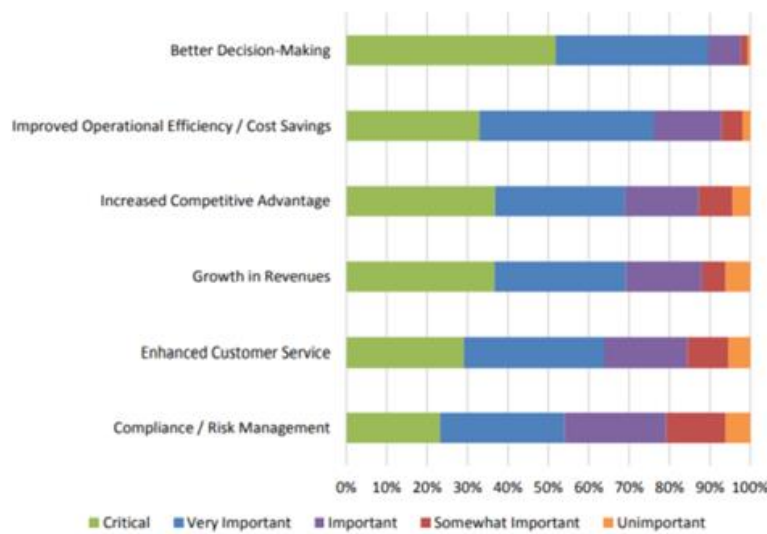


Figure 1: BI objectives

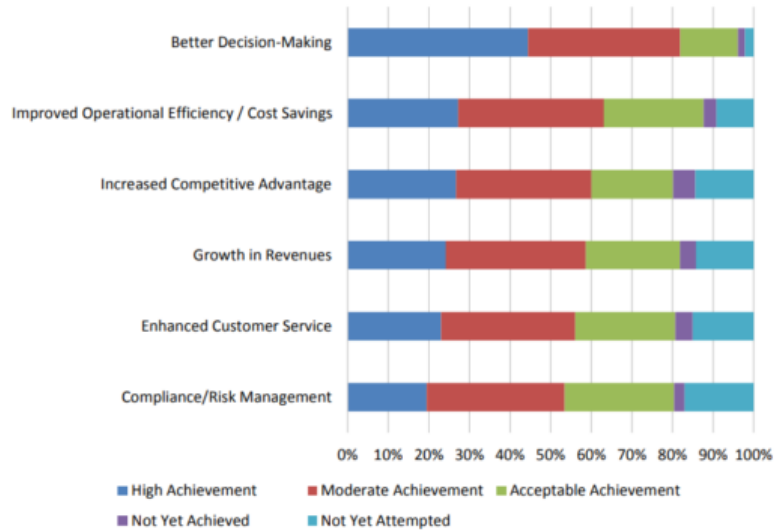


Figure 2: BI achievements

1-2- The targeted audience for BI organizations

Responsible for high-level decision-making and overall strategy development, it is no surprise that executives are the most targeted audience for BI organizations. According to the 2022 Wisdom of Crowds report [5], executive and administrator positions are the most likely primary (65%) and potential (96%) targeted users for BI. Following senior management, mid-level managers are about 80% likely to be primary or secondary targeted users. However, despite the continued emphasis placed on higher-level roles, there has been an increasing interest in the customer demographic. Regarding the chart, it is found that businesses that make BI accessible to all potential target audiences are more likely to be completely successful with BI. As a matter of fact, high levels of customer targeting are more than twice as likely to occur at completely successful than somewhat unsuccessful and unsuccessful BI organizations. [4], [1]

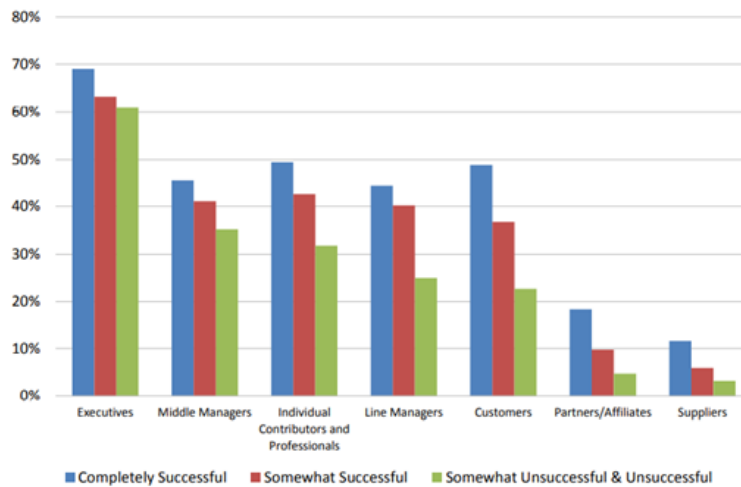


Figure 3: Targeted users by the success of BI

1-3- Budget plan for business intelligent

According to the 2022 Wisdom of Crowds report, the percentage of organizations using four or more tools has increased from 23 to 29 percent over the past four years. Likewise, the percentage of organizations using just two or fewer tools has decreased from 49 to 37 percent over the same time frame. The increased number of tools has also fueled an increase in spending. The report found that about 55% of organizations plan to increase their BI investment, with another 40% planning to at least maintain their current budget. Unsurprisingly, high-achieving businesses are more likely to increase their budgets across the board as they seek to continue building upon their already successful foundation. As the market continues to grow (and alongside it, companies' needs), likely so will their budgets. [8]

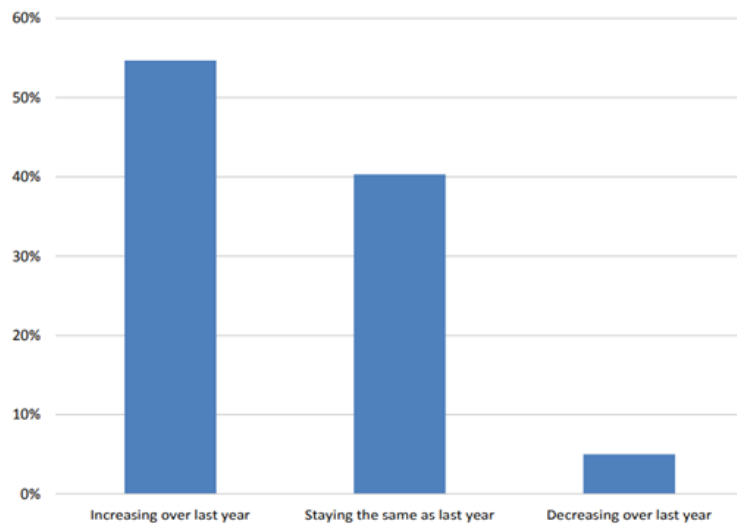


Figure 4: Budget plan for BI

1-4- Success is best measured with user feedback

An organization’s success with BI is a frequent means of evaluating how certain trends and practices translate to meaningful results. But to understand how these results compare, we must first ask ourselves, how do we measure “success with business intelligence?” According to the [5] report, the greatest measure of success is user feedback/satisfaction, coming in at an impressive 82% of organizations. This is 31% higher than the second-best measure of customer feedback/satisfaction which tops out at only 51% of organizations. According to respondents, the greatest contributors to success with BI are support from senior management, a culture that understands and values fact-based decision-making, and good communication between those who develop BI solutions and those who use them. Likewise, the greatest obstacles to success with BI are a lack of expert resources, a culture that does not fully understand or value fact-based decision-making, and a lack of data-literacy education. [9]

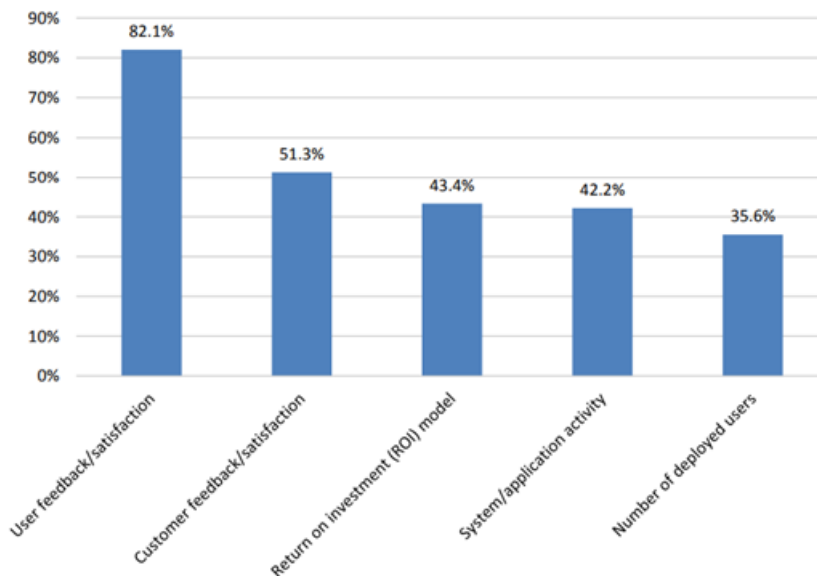


Figure 5: The measure of success with BI

1-5- Data visualization

More data on sales income, marketing effectiveness, customer interactions, inventory levels, production metrics, staffing levels, expenses, and other KPIs are produced by the company. Yet it might be challenging for consumers to recognize its storytelling when there is so much data to sort through. All that granular data can be transformed into useful, understandable, and visually compelling business information with the use of data visualization. The data visualization tools of today not only improve your ability to visualize your KPIs, but also combine data and use AI-driven analytics to find connections between the KPIs, the market, and the rest of the world.

1-6- The advantages of data visualization

By bringing data to life, data visualization becomes the expert storyteller of the insights concealed in statistics. Data visualization enables users to efficiently build strong business insights using live data dashboards, interactive reports, charts, graphs, and other visual representations. Data visualization is an effective technique for sharing and presenting information because it allows users to perceive the narrative hidden inside the numbers. Data visualization may be used to explain patterns, communicate trends, and assess the impact of

new tactics. These representations may be effective collaboration and communication tools, adding value to reports or providing context where it is needed. [6]

Although attractive, detailed images may be excellent instruments for conveying ideas, the ultimate advantage of data visualization is its capacity to promote better judgment. A few methods for integrating data visualization with strategic decision-making were incorporated after it:

- There is a clear picture of performance buried within the transaction, interaction, process, and behavioral data stored in systems. Data visualization allows us to recognize the broader context and higher-level scenarios within it. As a result, it will notice trends and spot patterns that would not be able to see if we are looking at numbers on our own.
- Bringing visual clarity to the story told within data helps to identify insights that lead to better decision-making, planning, strategies, and actions. How is the business performing, what needs to be modified, and where should it focus the resources? The ability to understand the significance of data drives more effective operations and decisions.
- With concrete numbers and tangible insights, you can be confident your decisions are backed by data. Having clear insight into performance metrics empowers the knowledge with the tools to make the right decisions at the right time.
- Once it has established a baseline, trends will begin to emerge. Track progress, spot trends, and begin using insights to drive informed strategic decisions. As build trends, shifts in patterns indicate if things drift off track, allowing to immediately address any sign of lowered performance.

1-7- Evaluating data visualization tools

The variety of data visualization tools available today ranges from free browser-based options to feature-rich systems that interact with a wide range of common corporate applications.

Yet with so many data visualization tools available, the challenge is picking the best one for a given set of requirements. In the end, wanting a tool that provides the necessary insights to aid in helping them concentrate on what matters most. [5]

Here are some key points to keep in mind when looking for a data visualization solution with the right balance of power, flexibility, and ease of use for your needs:

- Take a moment to list out what types of data have and what kinds of information and insights want to gather.
- Top data visualization solutions include features like business intelligence, analytics, and enterprise reporting capabilities, giving the flexibility to meet needs both today and tomorrow.
- Consider how to connect or import data and determine if the tool offers an integrated fit with systems.
- Think about where your final presentation will be published. Find a tool that allows flexibility to post and share data visualization wherever the story should be told and create data stories with amazing interactive visualizations and easily publish them to a blog or website.

Chapter 2: The importance of an interactive dashboard



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Shifting to interactive dashboards

The emergence of bright visual dashboards is a developing trend in the business world. It seems like everyone, from local small business owners to the CEOs of multinational combinations, is trying to adopt technology with visually engaging insights. However, what many of these insights offer is only a casual look at the data. By focusing on the trendy outer display, these companies are neglecting the full array of data-driven insights that come with a more comprehensive approach. These dashboards are aesthetically pleasing, but when you strip away the bells and whistles, they offer nothing more than a static view of the data. [8]

In today's competitive market, the best-in-class companies use visual dashboards that allow for data exploration. By combining visual displays with drill-down capabilities, organizations are allowing non-technical users access to multi-layered data that previously required IT assistance. By expanding the analytical roles of all employees, regardless of job function, they are seeing an increase in decisions derived from analytical processes. This increased reliance on analytics takes the guesswork out of day-to-day operations and provides an unambiguous return on investment.

Recent research published by Aberdeen Group suggests the potential for further tangible benefits from interactive dashboard use at a company-wide level. Best-in-class companies reap the benefits of interactive dashboards in a variety of quantitative and qualitative measures of success. Data exploration is no longer reserved for technical users. With reports of increased cooperation between departments and enhanced top-line and bottom-line growth, companies are leveraging the full capabilities of their dashboards to make data analysis a part of everyone's job description. [2]

Real-time digital dashboard reporting has enhanced operational intelligence, boosted efficiency, and raised user engagement levels for businesses that have adopted it. Almost 65% of people learn best visually. This implies that seeing is the greatest way for them to receive and absorb information. Although dashboards have become a useful tool for improving operational intelligence, their acceptance does not necessarily guarantee their best use. Dashboards offer the chance to accelerate corporate data display and analysis when used effectively. It is understandable that business analysts and decision-makers in organizations

embrace the potential of dashboards so highly when implemented well. It's crucial to understand what good dashboard usage looks like and how it may help. Dashboards have often been reporting tools for organizing and displaying organizational data. When dashboards are employed as a useful tool, managing a firm effectively is easier to understand. Yet, if they are not set up to provide useful key performance indicators (KPIs) or are just allowed to display information without allowing users to engage with it, they may not reach their full potential. [10]

2-1- What makes a dashboard interactive?

Basic dashboards display organized data, and an interactive dashboard allows users to act on that data instantly to create and assign tasks, or easily generate and filter reports to understand the underlying issues affecting performance and take immediate action. This aids organizational intelligence by highlighting where to assign resources or when to escalate challenging situations. Use interactive real-time dashboards to streamline business processes, increase employee engagement, and reduce latency in the information ecosystem. [5]

2-2- Advantages of interactive dashboards

2-2-1- Visualization

Dashboards offer a user-friendly and convenient platform for data analysis. Data dashboards help visual learners and provide team members the freedom to evaluate data and generate strategic insights. Analyzing raw data requires knowledge and expertise. Utilizing dashboards to visually communicate information enables more individuals within your organization to identify exceptions and opportunities. Dashboards democratize the potential to improve operational performance by establishing a connection between important data and personnel. [6]

2-2-2- Insight to Action

Interactive dashboards act as a springboard to drive user insights into actions. The ability to create and edit tasks and processes takes dashboard usage to a new level. Identify issues and then launch action from within the dashboard to save time and effort. When you can notify users to act instantly via the dashboard as soon as you notice any irregularity you eliminate the

need to open Outlook or reach for your smartphone. This alone streamlines your internal communications, improving response time for actionable requests. [6]

2-2-3- Flexible & Customizable

Users' insights can be translated into actions using interactive dashboards. The use of dashboards is elevated by the capability to create and change activities and processes. To save time and effort, identify problems and then start taking action from the dashboard. When you can alert users to take immediate action via the dashboard the moment you discover any anomaly, you don't need to access Outlook or grab your phone. Just doing this simplifies internal interactions and speeds up responses to requests that can be carried out. [7]

2-2-4- Real-Time & Mobile Friendly

Dashboards must be portable, just like users. Real-time performance snapshots are just as useful outside of the office as they are inside, if not more so. To offer easy access to real-time data, organizations should look for dashboards that are compatible with a variety of devices. Field-based team members may check their unfinished assignments while on the road, and managers can view operations from any location. Managers' ability to keep on top of time-sensitive information across all devices is accelerated and improved through dashboards that are mobile-optimized. [7]

2-2-5- Accountability & Alignment

Dashboards aid in maintaining accountability among team members. For instance, supervisors may view how their divisions are doing in real time, while salespeople can continuously benchmark their performance at a glance. Quick resource allocation faults or opportunities can be identified and taken advantage of by logistics. A department's or the entire organization's performance can be improved by improving visibility into operations, which can be a positive cycle for your firm. It might take time for everyone in an organization to align when changing competitive forces cause you to change your focus and implement new initiatives. To inform employees and promote the adoption of new procedures and larger organizational change,

create dashboards that highlight new KPIs. For instance, a Customer Success team keeps an eye on a KPI called "initial response time" to ensure performance. Management advises shifting the focus to resolving questions in a shorter amount of time after reviewing operations. The shift in departmental focus is readily stated by updating the Customer Success dashboard to reflect this new thinking, which enables immediate alignment. [5]

2-2-6- Reporting & Drilldowns

Dashboards compile a snapshot of KPIs from an underlying dataset, which drastically cuts down on reporting time. Organizations used to invest a lot of time and money into gathering and processing data to provide useful information. This frequently necessitated data exports and intensive spreadsheet manipulation for analysis. Dashboards are especially valuable to managers and analysts since they do a lot of the tedious formatting and processing work for users. [8]

Chapter 3: Organizational Structure



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3-1- About Company

The main vision of the market research department is to provide the context for strategic decisions to enable the future success of BMW. And for its mission, BMW generates insights on brands, customers, products, and the market today and derives predictions for the future. On this basis, BMW defines brand architecture and transforms brands to ensure their future readiness. Furthermore, they forecast market and segment sizes as well as competitors' product portfolios. BMW Act as an objective adviser and strive for relevant insights and data to enable the organization to draw the best possible decisions even in uncertainty. To do so, BMW continuously grows the team's assets by combining diverse profiles, subject matter, expertise, and profound methodological know-how While gradually adding data and analytical skills individually per role. Finally, BMW derives data by publishing studies and analytical insights, and dashboards through market research space. The BMW Group successfully manufactures automobiles and motorcycles for the premium and luxury segments on a global basis. With BMW, MINI, and Rolls-Royce, the BMW Group owns three of the best-known brands in the automotive industry worldwide. It also occupies a strong market position in the premium motorcycle segment. The BMW Group employed a workforce of 118,909 people worldwide. BMW AG, based in Munich, Germany, is the parent company of the BMW Group, which comprises BMW AG itself and all subsidiaries over which BMW AG has either direct or indirect control. BMW AG is also responsible for managing performance throughout the Group, which is sub-divided into the Automotive, Motorcycles, and Financial Services operating segments Presentation of segments. The group's Other Entities segment primarily comprises holding companies and group financing companies. The structure of the BMW Group changed significantly at the beginning of the financial year 2022 due to the BMW Group's majority acquisition of the joint venture BMW Brilliance Automotive Ltd. In 2021, the BMW Group demonstrated how profitability and transformation can go hand in glove, despite tough market conditions. Electric mobility is gathering pace, with delivery figures on a steep upward trajectory. At the same time, the BMW Group is working on digital solutions that make life more convenient for customers and provide access to a broad range of services. The BMW Group's vision of a circular economy is gradually taking

shape, the goal being fully sustainable mobility. In the BMW Group's view, a key prerequisite for a company's profitability is that its activities are compatible with external economic, ecological, and social interests. Conversely, profitability is the prerequisite for a company's ability to develop sustainable and innovative technologies, ensure job security, and cooperate with all its business partners along a value chain that is striving to become increasingly sustainable. For this reason, since the financial year 2020, the BMW Group has kept stakeholders informed of its business performance by reporting on an integrated basis. The Integrated Group Report 2021 aims to provide a clear and comprehensive insight into the BMW Group and explain the activities in a transparent, comprehensible, and measurable manner. BMW understands integrated reporting is among the subjects of an ongoing discussion currently taking place between stakeholders, regulators, and reporting entities. The status achieved to date is therefore still subject to constant review and continuous improvement. The BMW Group is keen to demonstrate to its shareholders how economic, ecological, and social issues complement one another and are often mutually dependent, and which general external conditions influence the company and define our potential to boost sustainability. [9]

3-2- Business model and segments

The BMW Group is particularly fascinating due to its innovative products and cutting-edge technology as well as its rich history that has been shaped by talented designers, innovators, and trailblazers. Today, the BMW Group is the world's top producer of luxury cars and motorbikes as well as a top provider of financial and mobility services. It has 31 production and assembly sites spread over 15 countries, as well as a global sales network. Being a pioneer in innovation, the BMW Group sets trends in production technology and sustainability through its use of clever material combinations, a technical push toward digitalization, and resource-conserving manufacturing. Concurrently, value chains' adaptability and ongoing optimization assure competitiveness.

Long-term thinking and responsible action are the basis of economic success. Ecological and social sustainability, comprehensive product responsibility, and a clear commitment to conserving resources are therefore an integral part of our strategy. With Efficient Dynamics, the BMW Group consistently implements the principle of sustainable mobility

and is steadily reducing its vehicles' fuel consumption and emissions.

The BMW Group develops, manufactures, and sells innovative premium automobiles and motorcycles on a worldwide basis. It also offers a broad range of financial and mobility services. The Group is structured into operating segments, namely the Automotive, Motorcycle, and Financial Services segments. Automotive segment The BMW Group manufactures BMW, MINI, and Rolls-Royce brand vehicles. The BMW brand caters to a broad variety of customer requirements. Its wide-ranging model portfolio covers several automobile classes, ranging from the premium compact class, the premium mid-size class, and through to the ultra-luxury class. Alongside its state-of-the-art plug-in hybrids and vehicles powered by highly efficient combustion engines, the BMW brand also includes all-electric models manufactured under the BMW I sub-brand, such as the BMW iX and the BMW i4 launched in 2021, as well as modern plug-in hybrid models and a high-performance vehicle belonging to the BMW M sub-brand. The MINI brand promises driving pleasure in the premium compact segment, and, alongside models powered by efficient combustion engines, it also offers plug-in hybrid and all-electric models. The all-electric MINI Cooper SE1 was the best-selling model in the MINI family at the year. With a tradition stretching back well over a century, Rolls Royce is the ultimate marque in the ultra-luxury class. Rolls Royce Motor Cars specialize in providing bespoke customer specifications and offer the utmost in terms of quality and service. Its comprehensive range of products enables the BMW Group to meet the diverse expectations and needs of its customers worldwide. The global sales network of the BMW Group's automobile business currently comprises more than 3,500 BMWs, 1,600 MINI and over 150 Rolls-Royce dealerships. [7] , [9]

3-3- Motorcycles segment

As in all other areas, the BMW Group focuses rigorously on the premium segment with its Motorcycles segment and its model range of motorcycles and scooters in the Sport, Tour, Roadster, Heritage, Adventure, and Urban Mobility categories. BMW Motored also offers a broad range of equipment options to enhance riding safety and comfort as well as personalized configurations. The Motorcycles segment's sales network is organized similarly to that of the Automotive segment. Currently, BMW motorcycles are sold by

more than 1,200 dealerships and importers in over 90 countries worldwide. [9]

3-4- Financial Services segment

The BMW Group is a leading provider of financial services in the automotive sector. It offers these services in more than 50 countries worldwide via companies and cooperation arrangements with local financial service providers and importers. The Financial Services segment's main line of business comprises credit financing and the leasing of BMW Group brand automobiles and motorcycles to retail customers. Customers can also select from an attractive array of insurance and banking products. Operating under the brand name Alphabet, the BMW Group's international multi-brand fleet business provides financing and comprehensive management services for corporate car fleets in more than countries. These services also include assisting customers to manage their fleets on a sustainable and climate-friendly basis. Financing dealership vehicle fleets serve to support the dealership organization and rounds off the segment's range of services. Global Overview the BMW Group operates on a worldwide basis. The BMW Group's largest automobile and motorcycle markets are in Europe, particularly in Germany and the United Kingdom (UK) as well as in China and the USA.

3-5- Integrated strategy

The BMW Group operates at the intersection of challenging, increasingly complex, and differentiated conditions around the world. This includes:

- Global competition
- Megatrends such as electrification and connectivity
- A capital market focused on profitability and growth
- Sustainability
- Diverging social expectations in the face of climate change

BMW constantly refines its corporate strategy and aligns its strategic targets with these external factors and their dynamic rate of change as important input parameters. The BMW Group's integrated strategy is based on fundamental elements, like the integrity of the actions. The BMW Group strategy is developed from an analysis of the global megatrends that are crucial to the transformation of the automotive industry and essentially comprises the integrated and continuous strategy process, the target system,

and corporate management. A company's success depends to a large extent on its ability to recognize changes in its environment early on, plan for different scenarios, effectively manage risks, and take advantage of opportunities that may arise from such changes Risks and opportunities. To this end, BMW continuously monitors the business environment in the key regions, using available data to analyze in detail the trends and developments that could affect the business in the future. The most important megatrends with long-term implications for the BMW Group's business model are currently climate change and the reduction of carbon dioxide (CO₂) emissions, electromobility, digitalization, and connectivity – including automated and autonomous driving, as well as mobility patterns within society. Mobility patterns Individual mobility appears likely to remain a fundamental human need for the foreseeable future, although vehicle ownership depends to a large extent on income, household size, and location (urban/suburban). Mobility services, so-called on-demand mobility (ODM), will remain relevant, especially in urban areas, but will mainly be used as a supplementary option for Mobility concepts and services. Around the world, the conditions for individual mobility in cities and their surrounding suburban areas are developing very differently in some cases and depend above all on the location of these conurbations, their population density, and the focus of emissions policy in the respective urban regions. [10]

3-6- Climate change and CO₂ reduction

see the consequences of climate change as a major challenge for the future. As governments around the world work to translate the goals of the Paris Climate Agreement into national laws, investors are increasingly evaluating companies and their business models. The European Union (EU) sees itself as a global leader in achieving these climate goals. Within the EU, the Sustainable Finance Framework aims to classify a company's business activities according to sustainability criteria. The US government has also proposed more ambitious climate-protection goals that aim to halve greenhouse gas emissions by 2030 from 2005 levels. China is relying on fleet limits and a growing percentage of zero-emissions vehicles. [11]

3-7- Digitalization and connectivity

is setting new standards for digitalization. Customer desires are increasingly influenced by the world of consumer electronics and are an important factor in purchasing decisions Innovation and customer orientation. In addition to the new possibilities, digitalization can offer customers, the further potential lies in networking mobile value creation. To create a virtual platform and meet future challenges, the BMW Group founded the Catena-X Automotive Network, together with other manufacturers, system suppliers, and technology partners' Production, purchasing, and supplier network. [11]

3-8- Automated/autonomous driving

Alongside digitalization, the development of automated/autonomous driving remains a key expectation for the future of mobility. Due to the importance of this topic for the automotive industry and the complexity of the technologies and expertise involved, extensive funding is being channeled into development in this area worldwide.

Concrete requirements and regulations for autonomous driving are likely to be in place in individual countries and regions by 2025. The aim of all regulators is assumably to authorize autonomous driving systems in the medium-term Products and mobility solutions. The strategy is integrated into annual longer-range corporate planning, with implementation monitored by a target system that is comprised of aspects of finance, customers, processes, learning, and development [12]

3-9- Corporate strategy

The BMW Group's corporate strategy referred to as the "BMW Group strategy", forms the core of the integrated approach. It defines the framework for decision-making and lays the foundation for the Company to maintain a consistent focus on profitability, growth, and sustainability, even in an increasingly dynamic environment.

The BMW Group strategy comprises four elements: position, direction, strategic approach, and collaboration. These formulate the various aspects of the aspirations and are combined in a "strategy arrow" that serves as a symbol for the forward-looking approach. This strategic framework provides a fixed point of reference for all decisions of Company-wide significance. [13]

3-9-1- Position –What does the BMW Group stand for?

The BMW Group is committed to first-class individual mobility and contributes to sustainable development. It aims to find the right balance between business, the environment, and society. The BMW Group combines driving pleasure and responsibility without compromise and, together with its partners, leads the industry in environmental, social, and integrity standards. The Company is committed to the Paris Climate Agreement and provides a verifiable track record of continuous improvement. To achieve this and reduce the impact on the environment, the BMW Group is promoting the reduction of CO₂ emissions as well throughout the whole product life cycle as the principles of the circular economy – from the supply chain to production, the use phase, and the recycling of its products. For this reason, BMW has also laid out ambitious targets to reduce CO₂ emissions by 2030 (the reference year 2019), understood as follows: 1. In the use phase of the vehicle, an average reduction of more than 50 % for every kilometer driven 2. In production, a reduction of 80 % for every vehicle produced 3. In the supply chain, a reduction of more than 20 % of Measurable science-based targets, initially up until 2030, has been firmly established across the Company, laying the foundation for the reduction of CO₂ emissions. BMW has joined the Science-Based Targets Initiative (SBTi) for this purpose. This will enable them to guarantee transparency and comparability in the validation and measurement of the targets and, at the same time, ensure they are in line with the latest scientific findings on CO₂ and emissions. Control parameters such as life cycle CO₂ emissions and secondary raw material quotas are already important performance indicators during the development phase of the vehicle projects Performance indicators. To leverage the potential for lowering CO₂ emissions during the use phase the BMW Group is actively working on numerous projects and initiatives to improve the framework conditions for electromobility. However, while the ambitious goals of the Paris Climate Agreement are designed to tackle climate change in the transport sector, they can only be achieved through a combination of all modern drive technologies in addition to electromobility that is closely aligned with customer needs and different mobility requirements around the world. Modern combustion-engine technology continues to make a meaningful contribution to the effective reduction of CO₂ emissions worldwide. For this

reason, the BMW Group offers those customers who choose not to buy an electrified vehicle – because of their mobility needs or because the prerequisites are not met – vehicles with modern, efficient internal combustion engines that rely on technology that is continuously further developed. Plug-in hybrid (PHEV) concepts also provide a good alternative in these circumstances.

Sustainability is built into individual market strategies across the global sales organization. Centralized measures are combined with local activities in the markets to implement a holistic program. Best practices in the fields of environmental protection, social sustainability, corporate citizenship, and governance are also shared within an established international sustainability network. [13]

3-9-2- Direction –What drives the BMW Group?

Direction is the second strategic element, after position. The BMW Group offers exciting products for current and future generations and secures its independence as a company by maintaining a high level of profitability. The BMW Group is shaping the future of sustainable mobility with its passion and a

strong capacity for innovation. Thanks to its exciting products, the Company can achieve maximum customer satisfaction and brand strength and thus grow its market share. The focus on profitability is a very important aspect of the BMW Group's corporate management system. All measures and initiatives are aimed at further developing the BMW Group's strong economic base, so it can continue to operate independently and invest in the future. To underline the importance of the BMW Group's economic performance capabilities, the ambitious financial targets are tied to the following strategic key performance indicators: EBIT margin in the Automotive segment (between 8 and 10%), ROCE in the Automotive segment (at least 18%) and Group EBT margin (more than 10%). As part of focus on efficiency, regularly assess ways to utilize synergies and efficiencies across the Company to reduce the complexity that arises from increasingly strict and heterogeneous regulatory requirements.

Faster, digitalized processes within lean structures are fundamental to systematically leveraging efficiencies. In vehicle development, for instance, they see considerable potential for reducing process time through digitalization. In addition to this,

distinguishing the BMW Group from its competitors, they are also taking advantage of the expanded possibilities of digitalization for customer contact, with integrated product and service offerings, functional upgrades, and customer support. The BMW Group is also bolstering its portfolio with attractive new models – especially in highly profitable segments. [11]

3-10- Smart data analytics

Industry 4.0, also known as digitalization in production, creates new possibilities for the whole BMW Group production system by making it possible to satisfy customized client requests and improving the flexibility and standard of manufacturing procedures. In the long run, modernization is also advantageous to the employees. In the following technological clusters: Smart data analytics, Smart logistics, Innovative automation & assistance systems, and Additive Manufacturing, the BMW Group is moving forward with the digitization of its production system. Digitalization and innovative technologies are impacting the entire BMW Group production value chain. From press shop to body shop to paint shop, from assembly to logistics – every stage of production benefits from the use of digital processes. Smart data analytics includes applications used to capture and evaluate data and improve processes. Factory digitalization, for example, enables a three-dimensional image of a production plant to be generated with millimeter accuracy. Later, 3D data can also be used in modifications and calculations at the factory. Artificial intelligence (AI) supports and relieves employees in standard production. Fast, efficient, and reliable technology ensures employees do not have to check model inscriptions against order data during the final inspection. This is now taken care of by AI, which alerts the employee if an inscription is not correct. The production system of the BMW Group is significantly improved by this and other AI applications. Throughout the construction of a car, hundreds of bolted connections are analyzed by algorithms, which give valuable information for more accurate fault detection. An interactive 3D world is simulated in real time using virtual reality. The technology has genuine additional value for both businesses and players. The multinational team at the BMW Group Virtual Reality Lab develops virtual environments and scenarios that may be used, for instance, in the logistics industry, to optimize procedures and safety. The results of intelligent data analysis are utilized to

enhance quality across the whole manufacturing and logistics process, as well as beyond. Colleagues were easily able to expand process specifications to include a subjective analysis that was important to them. The BMW Group is creating innovative systems for intelligent logistics. Information on the whole supply chain is available in real-time thanks to smart data technology. This makes it possible to promptly and flexibly modify supply delivery to plants in response to shifting circumstances. The major use of autonomous trolley trains, which employ laser signals to automatically travel around the manufacturing halls, is assembly logistics. Smart Transport Robots are capable of autonomously moving up to 0.5 tons of parts from point A to point B. Wireless transmitters can establish their position and then choose the best path to take to get there. Powered by recycled BMW i3 batteries, they can drive for eight hours. With Connected Distribution, the vehicle sends and receives important information end route from the plant to the dealership. When it comes to a stop, the vehicle relays its current geolocation and status to the logistics center via a mobile phone connection. The emphasis is on applications including supply chain digitization initiatives, autonomous plant transportation systems, and logistics robots. In BMW Group factories across the world, innovations resulting from several pilot projects are being applied in logistics. Innovative automation entails, on the one hand, deploying intelligent solutions to free up workers and, on the other, enhancing human adaptability and sensitivity with robotic capabilities. Lightweight robots can operate beside humans without any kind of safety barrier. Working side by side with humans, collaborative robots complete demanding, fine-grained tasks. They can only go at a certain pace and stop if there is any threat. [12]

Chapter 4: Problem and solution



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4-1- Definition of problems

Market research dashboards should be one of the biggest and most important parts of a market researcher's toolkit. Market research dashboards allow researchers and consultants to present the data in a way that is both informative and visually engaging. Unlike static PowerPoint slides, market research dashboards can be interactive and live, so the viewer can now actively participate in their own data story.

Until now, dashboards have either involved a major headache to create or outsourcing. But it can easily create them in the BMW office. Being able to create market research dashboards opens a world of possibilities. Not only are dashboards an efficient way of presenting information and data, but their interactive approach empowers users alike to ask and answer multiple questions.

There were PowerPoint presentation charts turned into interactive dashboards that they can flexibly drill down to split groups. The filters include age, gender, maker, segment, and item to be shown. There is some logic behind the charts for instance in China in general due to its cultural effect answers much more positively than the other markets. It is informative to show an index-based chart for the effect of scale and devices just for one market and compare each market in an interactive dashboard for visualizing different items.

Furthermore, it is transformed from a wide dataset to a long dataset in an integrated platform. It was already converted and cleaned in R and SPSS but the advantages of using consolidated tools for data analysis for visualization include:

- **Ease of Use:** Using a single tool for data preparation, analysis, and visualization on an integrated platform can streamline and speed up the data analysis and visualization process.
- **Improved Data Governance:** Because it provides a centralized location for data management, an integrated platform enables improved data governance, which in turn can enhance security and lessen the likelihood of data breaches.
- **Better Collaboration:** A single point of access to data and analysis makes it easier

to share and update information on an integrated platform, which improves team collaboration.

- **Improved Data Quality:** A central location for data validation, which can enhance the accuracy and completeness of data, is made possible by an integrated platform, which enables better data quality.
- **Scalability:** An integrated platform is suitable for large organizations because it makes it simple to add new data sources and users, manage large amounts of data, and allows for scalability.
- **Speed:** Because it eliminates the requirement for data transfer between various tools and lowers the likelihood of errors, an integrated platform speeds up the process of data analysis and visualization.

In conclusion, an integrated platform and tools for data analysis and visualization can facilitate team collaboration and insight sharing while also increasing efficiency, quality, and effectiveness.

4-2- Solution

4-2-1- Introduction

Making interactive visualizations for data visualization is a procedure used to discover patterns, variances, and get insightful knowledge from the data. The BMW group uses data visualization primarily to examine and clean data, explore and discover, and communicate outcomes to management. In general, interactive dashboards are trending in market research. Market research dashboards provide a simplified summary of data. The main aim is to make it easy for the user to understand important result areas. Depending on the type of study and needs of the client, the dashboard is complex or simple.

A market research interactive dashboard is an efficient way of presenting market research studies and sharing information as reports, charts, or infographics in the BMW group. The users in different departments can take advantage of the analysis of dashboards of the IMPACT platform in market research. Plenty of questions, surveys, and data were collected from disparate sources both online and offline, making it difficult to manage. Complexity increases with error-prone data entry at levels. Taking it longer to organize,

study, analyze and present as reports or slides.

With a market research interactive dashboard, all users can work with data with ease. It allows them to track major research KPIs with a click of a button. To name a few the Market research KPIs in the BMW group are brand awareness, product satisfaction, product pricing, customer satisfaction, customer feedback, market forecasting, the performance of BMW, and its relevance in comparison with the other competitors and promote score. A market research dashboard in the customer segmentation of the BMW group allows ease to track and analyze the study. Every dashboard meets the expectation and specific requirements related to various workshops and meetings. The flexibility of the IMPACT platform lies in the customized reports module will generate reports and metrics and the reports are shared with stakeholders at varied hierarchies.

The examples of market research data that visualize with a dynamic and interactive dashboard included:

- **Brand analysis** the most classic way of visualizing a brand analysis on a market research dashboard is with a brand funnel. Brand funnels usually measure the awareness, familiarity, consideration, purchase, repeat purchase, and loyalty of customers for that brand.
- **KPI tracking** A Key Performance Indicator (KPI) is one of the most important measurable values that shows how effectively a company or organization is achieving its business objectives. Companies use KPIs to evaluate their success at reaching targets over time.
- **Conversion rate and optimization** A conversion rate is the percentage of people or companies that move from one stage to the next stage in a process. The main goals of tracking a conversion rate are to identify weak spots in a company's customer acquisition process or to compare the performances of different marketing initiatives.
- **Product innovation** is a great market research dashboard for insight into future product development, pricing decisions, and potential future markets. It normally

measures three metrics: usage intention, purchase intention, and willingness to pay.

- **Customer satisfaction and Net Promoter Score** This market research dashboard surveys already existing customers and asks them about their experiences with a particular brand. One of the most important metrics here is the Net Promoter Score (NPS) which evaluates customer loyalty by asking how likely a customer would be to recommend the product or service to someone else on a scale of 0-10. Market researchers often compare Net Promoter Scores across their industry. Another metric that customer satisfaction measures are the Customer Effort Score (CES) which asks customers to evaluate how difficult it was to get support. Ultimately, customer satisfaction measures the perceived quality of a product, the pricing, the design, and the customer service.

4-2-2- Effectiveness of Visualization across Data Types

The usefulness of various graphics across data kinds is seen in the table below. Understanding how variables (data characteristics) may be divided into different data kinds can help you better grasp the table. The variables without any ordering are categorical ones. gender, schoolwork, marital status, and job title.

Numerical Variables are segmented into Ordinal and Quantitative variables.

Ordinal variables are categories that can be ranked. For instance, Satisfaction (Good, Bad, and Average), Potential (High, Medium, and Low).

Quantitative variables are the ones that can take any range of numeric values between -infinity to +infinity. Like Age, Salary, Revenue, Sales.

chart	X-axis	Y-axis	analysis	Example
Scatter plot/line plot	continuous		Understanding the linear, non-linear relationships between two variables Trend analysis, change in KPI over time	How sales of the productions varied over a period?
Bar graph	Categorical/discrete continuous	continuous	How can any performance indicator vary across different categories?	How sales in 2019 varied for different brands?
Stack bar graph	Categorical	continuous	Relative comparison of multiple categories within a category	Comparison of revenue generated by competitors across different segments
Box plot	continuous		Outlier detection Analyzing data distribution across median	How different sales figures across a year is distributed?
Pie chart	Categorical and continuous		Relative comparison of different categories for one single entity in terms of proportion	What percentage of sales in 2019 is constituted by different products under BMW?

Table 1: different graphs for visualize patterns regarding data type of the variable

4-2-3- Architecture

Using Foundry will be able to access a variety of data sources, quickly and easily analyze data across systems, and actively collaborate with your team members without leaving the platform. Foundry is a data integration platform with a series of analysis tools built on top of it to allow access to the data in a variety of ways, depending on your desired outcome. This Platform provides an interface for users to search, navigate, and discover content and applications. Its main features include the navigation sidebar, application windows, and a helper panel. Projects apply vertical structure to organize data by teams, objectives, types of data, or (real world) projects. [14]

Any given analysis could involve any or all of these tools, so it's important to understand how they work together. They can loosely be grouped into tools to build and transform data, tools for data analysis, and tools for building reports, applications, and workflows. The Foundry platform follows a micro-service architecture, with key functionality compartmentalized and deployed in highly available configurations. The diagram below summarizes some of the key services within the platform.

It can be accessed by many of the analysis tools via the +New button that appears

throughout the Foundry Platform. it will cover many of them throughout the training, but here is a quick intro to the most common:




WORKFLOW	FOUNDRY TOOL	TOOL OVERVIEW	CORE USER PROFILE
BUILD PIPELINES - <i>Ingest, transform and connect data</i> 	DATA CONNECTION	Perform and schedule large uploads of data	Developers & Database Admins
	CODE REPOSITORIES	Collaborative data transformation	Developers & Data Scientists
	PREPARATION	Visual data cleaning and manipulation	All Users
	DATA LINEAGE	Explore the data pipeline	All Users
ANALYZE DATA - <i>Discover insights from your data</i> 	CONTOUR	Top-down analysis for large datasets	All Users
	QUIVER	Plot, transform, and analyze time series data	Developers & Data Scientists
	CODE WORKBOOK	Analyze and transform data using code	Developers & Data Scientists
OPERATIONALIZE DATA - <i>Showcase your insights and create operational workflows</i> 	FUSION	Interact with live data through spreadsheets	All Users
	REPORTS	Create documents and dashboards to share your analytical work	All Users
	OBJECT EXPLORER	Explore objects, properties and relations	All Users
	SLATE	Build interactive visualizations and dashboards	Developers (Web)

Figure 6: Workflow in IMPACT platform

4-2-4- Data analysis and exploration for large dataset

The data were collected in the pre-study of the market research panel. Note that whereas the scale variation was balanced, the choice of the device depended on the participants resulting in unequal group sizes in these conditions. The sample size is $N = 15011$ (5000 participants in China, 5001 participants in Germany, and 5011 participants in the US).

It is a methodological survey for distinguishing the answers of groups based on mobile devices or desktop computers to design the questionnaires in a certain way. for instance, in Germany, it was asked “Do you prefer your car reflect your social position?” and the questioners answered depending on the scales A-D or D-A and devices mobiles, and computers. It can be shown the percentages of how many people responded to each category regarding different questions compared to each other.

Scale A-D: the presented scale ranged from "Agree strongly" to "Disagree strongly".

Scale D-A: the presented scale ranged from "Disagree strongly" to "Agree strongly".

ITEM	DESCRIPTION
beautiful cars	I like looking at beautiful car
classic lines	I like cars with classic lines and traditional styling
outperforms others	I prefer a vehicle that outperforms others
reflect my social position	The type of car I am driving needs to reflect my social position
reflection of my achievement	My vehicle is a reflection of my achievement
transport large items	When I buy a car being able to transport large items is important
traverse any terrain	I want to be able to traverse any terrain
eliminate stress from driving	I would like my car to do more to eliminate stress from driving
feel safe and secure	It is very important that I feel safe and secure in my car
fuel economy	Fuel economy is a leading consideration in my purchase decision
high driving position	I like a high driving position so I can see all around me
least expensive one	When I buy a car I choose the least expensive one that meets my needs
most comfortable ride quality	The vehicle should provide the softest most comfortable ride quality
most modern technology	When buying a car I like having the impression that the manufacturer built in the most modern technology available
most environmentally friendly one	When I buy a car I choose the most environmentally friendly one that meets my needs
pay more for environmentally friendly features	I would pay more for environmentally friendly features

Table 2: The parameter "Item" refers to the segmentation item of interest

Code Workbook will open a workbook interface that will allow analyzing and transforming data using an intuitive graphical interface with common languages like Python and SQL.

```
Def cleaned_waves1_2(BMW_xEV_Tracking_Waves_1_2_consolidated_2023):
    df=BMW_xEV_Tracking_Waves_1_2_consolidated_2023_01_06
    df = df.toPandas()

    #deleting idk options from q18
    list_of_numbers = list(range(93, 100))
    for a in list_of_numbers:
        df.iloc[:,a]= df.iloc[:,a].replace("I don't know this
feature/my app does not offer this feature", value=None)

    #remove strings for specified columns
    list_of_numbers1 = list(range(17, 30))
    list_of_numbers2 = list(range(36, 41))
    list_of_numbers3 = list(range(62, 75))
    list_of_numbers4 = list(range(93, 100))
    list_of_numbers5 = list(range(107, 111))
    list_of_numbers6 = list(range(114, 118))
    list_of_numbers7 = list(range(121, 125))
    list_of_numbers8 = list(range(128, 132))
    list_of_numbers9 = list(range(75, 90))

    merged_list= list_of_numbers1 + list_of_numbers2 +
list_of_numbers3 + list_of_numbers4 + list_of_numbers5
    merged_list = merged_list + list_of_numbers6 + list_of_numbers7 +
list_of_numbers8+list_of_numbers9

    for i in merged_list:
        df.iloc[:,i]= df.iloc[:,i].replace(regex=[r'\D+'], value="")

    #replace string with number
    list_of_numbersA = list(range(30, 36))
    list_of_numbersB = list(range(100, 104))
    list_of_numbersC = list(range(41, 49))
    merged_list1= list_of_numbersA +list_of_numbersB+list_of_numbersC
    for j in merged_list1:
        df.iloc[:,j]= df.iloc[:,j].replace('Agree strongly',
```

```

value="5")
    df.iloc[:,j]= df.iloc[:,j].replace('Agree somewhat',
value="4")
    df.iloc[:,j]= df.iloc[:,j].replace('Neither agree nor
disagree', value="3")
    df.iloc[:,j]= df.iloc[:,j].replace('Disagree somewhat',
value="2")
    df.iloc[:,j]= df.iloc[:,j].replace('Disagree strongly',
value="1")

    #replace strings by numbers
    list_of_numbersD = list(range(49, 55))
    for g in list_of_numbersD:
        df.iloc[:,g]= df.iloc[:,g].replace("Not very important",
value="1")
        df.iloc[:,g]= df.iloc[:,g].replace("Very important",
value="5")

    #adapt data type
    merged_list2 = merged_list1 + merged_list
    for b in merged_list2:
        df.iloc[:,b]=round(pd.to_numeric(df.iloc[:,b]),1)

    #new column wave year indicator
    df['Wave_year'] = df['Wave'].astype(str) + '-' +
df['Year'].astype(str)

    return df

```

Contour will open a point-and-click tool for data analysis, transformation, and reporting designed for users who do not code. Contour allows to quickly access datasets, conduct common analytical and logical operations in sequence to explore your data, debug data quality, and cleanse and transform your data.

Contour is a top-down analysis and visualization tool that will help drill down into subsets of the data, which are most relevant to your line of inquiry

Contour provides a point-and-click user interface to perform data analysis on tables at scale. These analyses can be used to create interactive dashboards that allow others to explore and investigate the data in a guided, structured way.

Key features of Contour include:

- Visualize, filter, and transform data without code.
- Organize complex analyses into analytical paths.
- Parameterize analyses to easily switch between different views of the data and results.
- Create interactive dashboards to share findings.
- Save analysis results as a new dataset for use in other Foundry tools.
- Leverage Contour expression language for more advanced transformations and aggregations.

Data processing can be used to look for obvious errors in the dataset including nulls, random values, distinct records, the format of dates, sensibility of spatial data, and string and character encoding. The below is a resource for using Contour's rich expression language and can be used as a reference for types, operations, and functions.

Concatenate columns as strings with the || operator:

```
dimension_y_axis
```

```
"scale_group" || ' & ' || "var_device_var_device"
```

Case/When/End

Case statements let evaluate multiple possibilities in one expression. Each statement is evaluated in order, and the THEN statement is executed for the first one to evaluate to true.

```
CASE
```

```
  WHEN "Item_Answer" == '5-very important' or '5-fully agree' THEN '5'
```

```
  WHEN "Item_Answer" == '4- important' or '4- agree' THEN '4'
```

```
  ELSE 'Null'
```

```
END
```

```

CASE
  WHEN "Index" like 'q16r4%' or "Index" like 'q16e4%' THEN 'Navigation System'
  WHEN "Index" like 'q26r%' or "Index" like 'q26e4%' THEN 'relax in the car'
  ELSE 'Null'
END
Scale_group
CASE
  WHEN "var_scaleorder_scale_group" == 'group A' THEN 'D-A'
  WHEN "var_scaleorder_scale_group" == 'group B' THEN 'A-D'
  ELSE NULL
END
visualiz_by
CASE WHEN $Item is 'beautiful cars' THEN
  "q25r1_I_like_looking_at_beautiful_cars_-_
  _First_of_all_please_let_us_know_your_views_on_motoring_in_general"
  WHEN $Item is 'classic lines' THEN
  "q25r4_I_like_cars_with_classic_lines_and_traditional_styling_-_
  _First_of_all_please_let_us_know_your_views_on_motoring_in_general"
  WHEN $Item is 'high driving position' THEN
  "q25r8_I_like_a_high_driving_position_so_I_can_see_all_around_me_-_
  _First_of_all_please_let_us_know_your_views_on_motoring_in_general"
  WHEN $Item is 'transport large items' THEN
  "q25r9_When_I_buy_a_car_being_able_to_transport_large_items_is_important_-_
  _First_of_all_please_let_us_know_your_views_on_motoring_in_general"
  WHEN $Item is 'pay more for environmentally friendly features' THEN
  "q25r11_I_would_pay_more_for_environmentally_friendly_features_-_
  _First_of_all_please_let_us_know_your_views_on_motoring_in_general"
  WHEN $Item is 'reflect my social position' THEN
  "q25r14_The_type_of_car_I_am_driving_needs_to_reflect_my_social_position_-_
  _First_of_all_please_let_us_know_your_views_on_motoring_in_general"
  WHEN $Item is 'most modern technology' THEN
  "q25r15_When_buying_a_car_I_like_having_the_impression_that_the_manufacturer_bu
  ilt_in_the_most_modern_technology_available_-_
  _First_of_all_please_let_us_know_your_views_on_motoring_in_general"
  WHEN $Item is 'feel safe and secure' THEN
  "q25r17_It_is_very_important_that_I_feel_safe_and_secure_in_my_car_-_
  _First_of_all_please_let_us_know_your_views_on_motoring_in_general"
  WHEN $Item is 'least expensive one' THEN
  "q25r16_When_I_buy_a_car_I_choose_the_least_expensive_one_that_meets_my_needs_-_
  _First_of_all_please_let_us_know_your_views_on_motoring_in_general"
  WHEN $Item is 'eliminate stress from driving' THEN
  "q25r18_I_would_like_my_car_to_do_more_to_eliminate_stress_from_driving_-_
  _First_of_all_please_let_us_know_your_views_on_motoring_in_general"
  WHEN $Item is 'most environmentally friendly one' THEN
  "q25r19_When_I_buy_a_car_I_choose_the_most_environmentally_friendly_one_that_me
  ets_my_needs_-_
  _First_of_all_please_let_us_know_your_views_on_motoring_in_general"
  WHEN $Item is 'outperforms others' THEN
  "q25r20_I_prefer_a_vehicle_that_outperforms_others_-_
  _First_of_all_please_let_us_know_your_views_on_motoring_in_general"
  WHEN $Item is 'most comfortable ride quality' THEN

```

```

"q25r21_Vehicle_should_provide_softest_most_comfortable_ride_quality_-_
_First_of_all_please_let_us_know_your_views_on_motoring_in_general"
WHEN $Item is 'traverse any terrain' THEN
"q25r22_I_want_to_be_able_to_traverse_any_terrain_-_
_First_of_all_please_let_us_know_your_views_on_motoring_in_general"
WHEN $Item is 'fuel economy' THEN
"q25r23_Fuel_economy_is_a_leading_consideration_in_my_purchase_decision_-_
_First_of_all_please_let_us_know_your_views_on_motoring_in_general"
WHEN $Item is 'reflection of my achievement' THEN
"q25r24_My_vehicle_is_a_reflection_of_my_achievement_-_
_First_of_all_please_let_us_know_your_views_on_motoring_in_general"
ELSE NULL end

```

Filter on multiple conditions

Combine two or more filter expressions with AND or OR:

```

("start_borough" == 'Queens') AND ("end_borough" == 'Queens')
"department" is 'sales' OR "department" is 'r&d'

```

A common data analysis task is finding the row with the minimum or maximum value for some column within a partition. For example, it might have a dataset with patient records and want to find the earliest date that each patient visited the office. It can be used two expressions to find these rows.

it has been to derive a new column first and then use that to filter, rather than doing everything in the filter expression. This is because cannot use window functions in filter expressions, due to a limitation of Spark SQL. First, derive a new column to find the min or max value for the partition. In the following example, it determines the most recent taxi ride each cab (identified by medallion number) has given, creating a new column most_recent_ride:

```

max("pickup_datetime") OVER (PARTITION BY "medallion")

```

Filtering will be ignored when no value is set for a parameter.

Create parameter

Temporary override applied to 2 parameters

Country Overridden

Germany X

Item Overridden

reflect my social position X

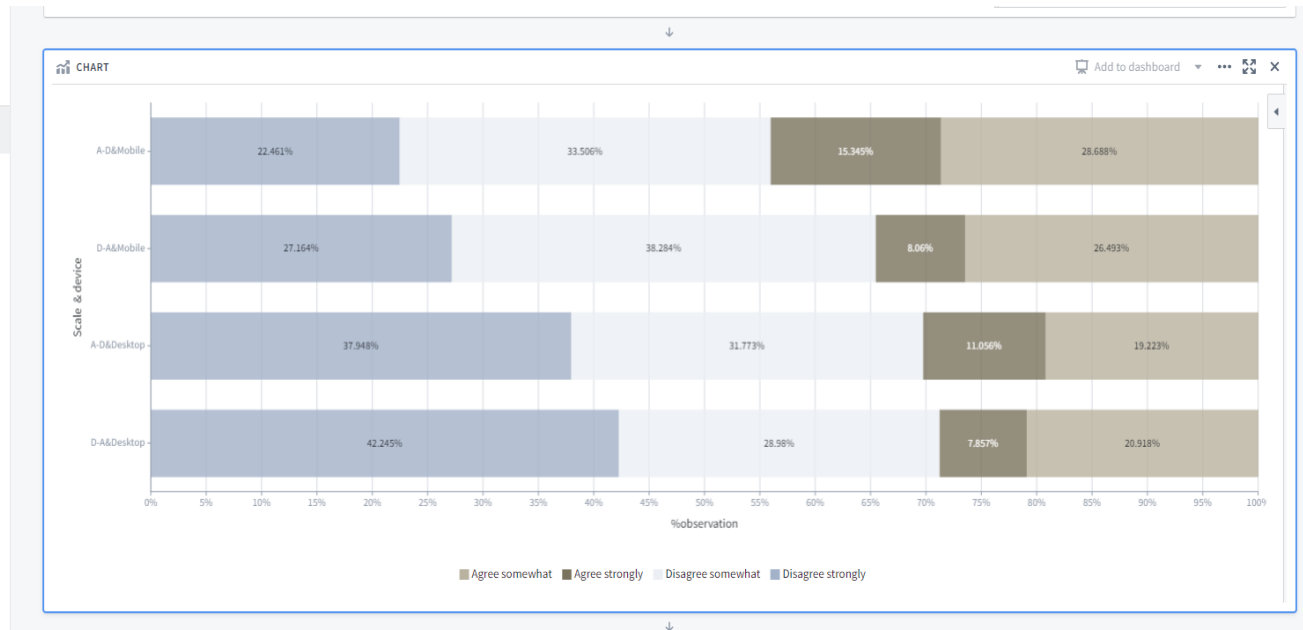


Figure 7: Interactive dashboards

Create parameter

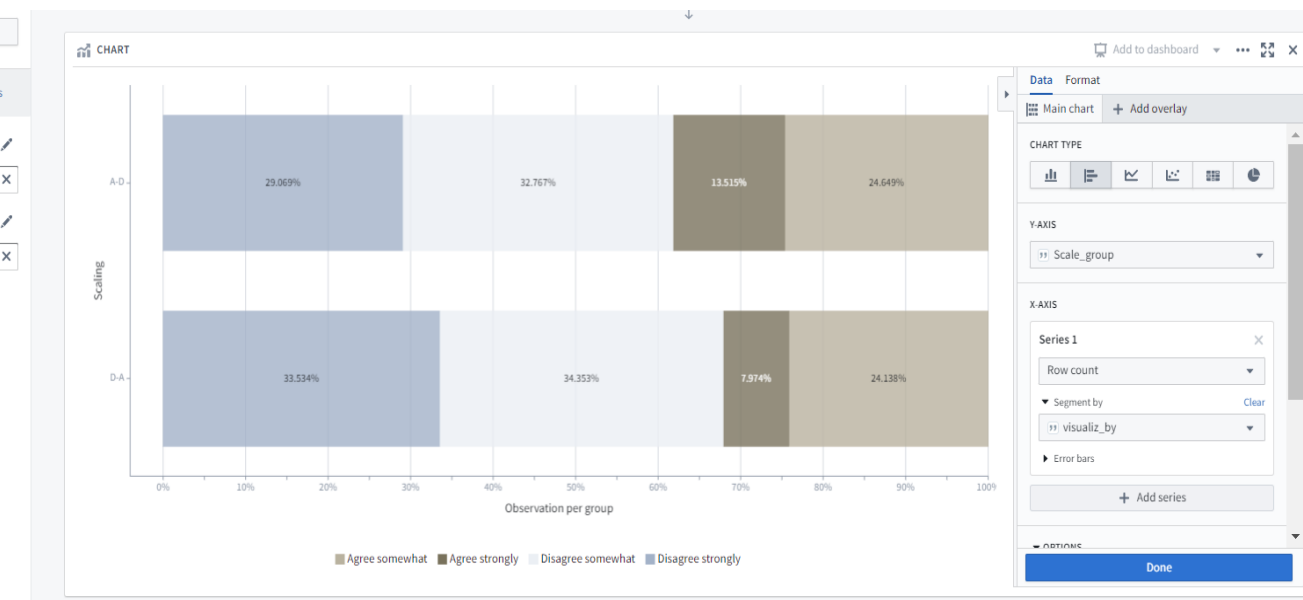
Temporary override applied to 2 parameters

Country Overridden

Germany X

Item Overridden

reflect my social position X



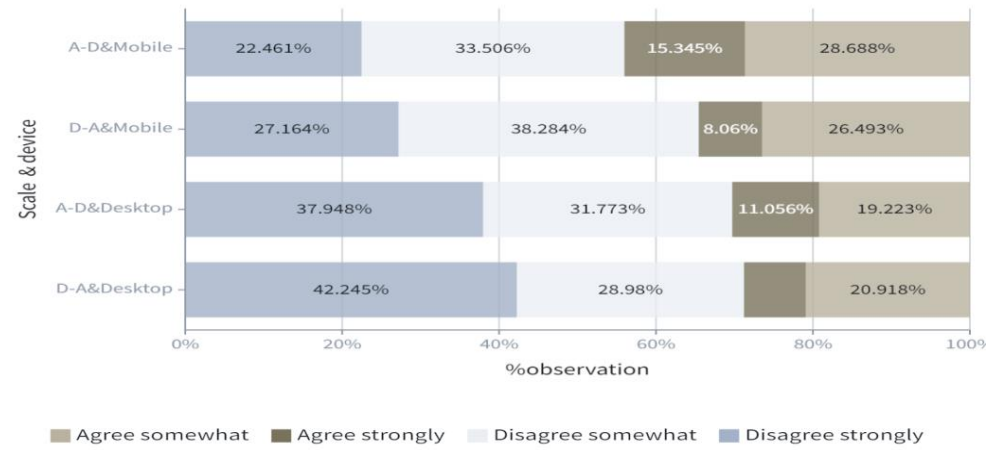
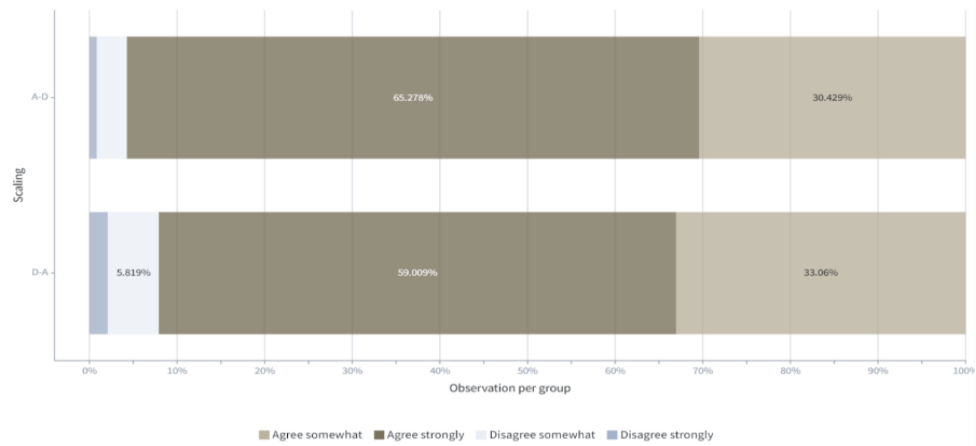


Figure 8: Final charts



Chapter 5: Conclusion



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In conclusion, the application of data science and visualization in the creation of interactive dashboards for market research has proven to be a beneficial tool for businesses, including the BMW group. It was proved in this study that data science and visualization approaches may give useful insights and improve the presentation of market research data. The resulting interactive dashboards may transmit complicated information in a more accessible and user-friendly manner, allowing businesses to make better-informed decisions. All analytical efforts are built on data visualization. It is a tool for data pre-processing as well as aiding in getting insights into the data. Effective outcomes communication depends on having the appropriate selection of visuals for various data kinds and business contexts. It is possible to present the analysis findings using Contour dashboards mode in IMPACT platform. The key functionality for dashboards mode includes chart-to-chart filtering, inline parameters, and a full screen presentation view. The growing need to quickly share data-driven findings in a compelling way has made data visualization tools surge in popularity over the last few years in the BMW group. When done correctly, a dashboard provides a comprehensive solution for viewers to actively explore the data in a way that is visual and interactive but does not require any special training. It contains charts, tables, images, or a mix of these elements, making a dashboard an excellent, single information source to share data and results.

Compiling your data into one view makes it easy to see and understand your insights and makes decision-making much faster. When interactive controls are enabled, users can filter different aspects to find the data they are looking for. A market research interactive dashboard is an efficient way to present market research studies. And share information as reports, charts, or infographics with stakeholders or clients. The use of interactive dashboards in market research is big asset agencies and companies can take advantage of. Plenty of questions, surveys, and data were collected from disparate sources. Both online(live) as well as offline(data) make it difficult to manage. Complexity increases with error-prone data entry at levels. Taking it longer to organize, study, analyze, and present as reports or slides and data analytics tools supporting

powerful visualizations should support the need.

Interactive dashboards are trending in market research. Market research dashboards provide a simplified summary of data. The main aim is to make it easy for the user to understand important result areas. Depending on the type of survey and the needs of the user, the dashboard changes.

With a market research interactive dashboard, one can work with data with ease. It allows users to track major research KPIs with a click of a button. To name a few of the Market research KPIs are:

- Brand awareness
- Product Satisfaction
- Product pricing
- Customer satisfaction
- Customer feedback
- Market forecasting
- NPS (Net Promoter Score)

A market research interactive dashboard allows end users ease to track and analyze the study. Every dashboard meets the customer's expectations and requirements, and the customized reports module will generate reports and metrics. The

reports are shared with stakeholders in varied hierarchies. This strategy, however, has disadvantages, including the requirement for vast volumes of precise data and specific technical expertise to construct and maintain the dashboards. Despite these hurdles, the benefits of employing data science and visualization in market research are evident, and this trend is expected to continue. Overall, the study emphasizes the relevance of incorporating data science and visualization into market research, as well as the need for organizations to invest in these tools and methodologies to compete. This study advances the use of data science and visualization in market research and paves the way for future research and development in this area in the BMW group.

In conclusion, this thesis has presented a thorough assessment of the use of data science and visualization in market research, as well as its influence. The study shows how these tools and

strategies may generate significant insights and improve the presentation of market research data. The conclusion underscores the significance of incorporating methodologies into market research and emphasizes the necessity for more study and development in this subject.

References

- [1] Wang, X., Chen, H., "Interactive Visualization of Large-Scale Market Research Data," *IEEE Transactions on Visualization and Computer Graphics*, vol. 26, no. 1, pp. 1107-1116, 2020.
- [2] "Visual Vocabulary. [online] ft-interactive.github.io," Github, [Online]. Available: <https://ft-interactive.github.io/visual-vocabulary>. [Accessed 23 Aug. 2020].
- [3] "Wisdom of Crowds Business Intelligence Market Study," Dresner Advisory Service, 2022.
- [4] "Microsoft.powerbi," Microsoft, 2022. [Online]. Available: <https://powerbi.microsoft.com/en-us/data-dashboards/>.
- [5] "Microsoft. power bi," Microsoft, 2022. [Online]. Available: <https://portal.dresneradvisoryservices.com/publication/market-reports/2022/wisdom-of-crowds-business-intelligence-market-study-2022/>.
- [6] "Strategy and research," illuminates realities, [Online]. Available: <https://www.aberdeen.com/>.
- [7] "The Statista website," 2022. [Online]. Available: [study_id60860_bmw-report.pdf](#).
- [8] "data-visualization," Microsoft, [Online]. Available: URL:<https://powerbi.microsoft.com/en-us>. [Accessed 2022].
- [9] "The BMW Group 2022," BMW , 2022. [Online]. Available: <https://www.bmwgroup.com/en.html>.
- [10] "The BMW Group," 2022. [Online]. Available: [BMW-Group-Report-2021-en.pdf](#).
- [11] B. group, "Quarter of Finacial statement report," BMW group, Munich, 2022.
- [12] B. group, "Impact of cut-edging and smart analysis in production," BMW group, Munich, 2022.
- [13] B. group, "Qarter Report," BMW Group, Munich, 2022.
- [14] F. a. IMPACT, "Tutorial for Data scientist," BMW group, Munich, 2019.
- [15]
- [16] R. Bhatia, " Data Visualization: A Practical Guide. .," *Springer*, 2017.
- [17] W. McKinney, "Data Structures for Statistical Computing in Python. Proceedings of the 9th Python in Science Conference," *Science*, pp. 51-56, 2012.
- [18] T. Watson, "The Rise of Data Visualization in Market Research," 2021. [Online]. Available: <https://www.qualtrics.com/blog/data-visualization-market-research/>.