



Expertise
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Developing Accessories Sales Performance Dashboard for the Case Company's Product Management

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<p>The main objective of this thesis was to develop a pilot version of accessories sales performance dashboard for the case company's product management and especially its product managers who are responsible for the development of accessories. It aims to support product managers to measure accessories sales performance in different markets by providing sales data at a global level. The purpose of the dashboard is to visualize sales of accessories by displaying metrics and Key Performance Indicators and thus support the product managers in their daily activities such as in business decision-making.</p> <p>The key findings of this thesis revealed that the company's product managers do not have a common dashboard of accessories sales performance that would cover worldwide sales data. Additionally, the company's product managers do not have standard metrics or KPIs. Also, developing a shared sales performance dashboard of accessories by themselves has been a challenge to the people because either they have not had time to build it, or they have not had enough skills to do it or then they have not had access to all the necessary data in order to build a dashboard which would cover global sales figures from accessories.</p> <p>As a result of the thesis, several accessories sales performance dashboards were created that include metrics and KPIs of accessories sales performance at the global level. Every product manager got their own dashboards that are easily available, easy to use and up to date. The dashboards will be implemented among the product managers inside the product management.</p>	
Keywords	Dashboard, Power BI, Business Intelligence, Metrics, Key Performance Indicators (KPIs)

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<p>Opinnäytetyön päätavoitteena oli kehittää pilottiversio lisävarusteiden myyntiä kuvaavasta koontinäytöstä kohdeyrityksen tuotehallinnalle ja erityisesti sen tuotepäälliköille, jotka vastaavat lisävarusteiden kehittämisestä ja myynnistä. Sen tavoitteena on tukea tuotepäälliköitä mittaamalla lisävarusteiden myyntiä eri markkinoilla ja tarjoamalla näistä myyntitietoja globaalilla tasolla. Koontinäytön tarkoituksena on kuvata lisävarusteiden myyntiä erilaisilla visuaalisilla mittareilla sekä suorituskykymittareilla ja siten tukea tuotepäälliköitä heidän päivittäisissä toimissaan kuten päätöksenteossa.</p> <p>Tämän tutkimuksen keskeiset havainnot paljastivat, että yrityksen tuotepäälliköillä ei ole yhteistä lisävarusteiden myynnin suorituskyvyn koontinäyttöä, joka kattaisi myyntitietoja maailmanlaajuisesti. Lisäksi yrityksen tuotepäälliköillä ei ole yhteisiä mittareita tai suorituskykymittareita. Lisäksi yhteisen koontinäytön kehittäminen lisävarusteiden myynnistä itsessään on ollut haaste tuotepäälliköille, koska heillä ei ole ollut aikaa tai riittäviä taitoja rakentaa sellaista itse tai sitten heillä ei ole ollut pääsyä kaikkiin tarvittaviin myyntitietoihin ja tässä tapauksessa globaaleihin myyntitietoihin, joita tarvittaisiin heidän tarpeisiinsa vaativan koontinäytön rakentamiseksi.</p> <p>Opinnäytetyön tuloksena syntyi useita koontinäyttöjä lisävarusteiden myynnistä, jotka sisältävät useita mittareita sekä suorituskykymittareita lisävarusteiden myynnistä globaalilla tasolla. Jokainen tuotepäällikkö sai useita omia koontinäyttöjä, jotka ovat heille helposti saatavilla, helppokäyttöisiä ja ajan tasalla. Koontinäytöt tullaan ottamaan käyttöön tuotepäälliköiden keskuudessa tuotehallinnan sisällä.</p>	
Avainsanat	Koontinäyttö, Power BI, Liiketoimintatiedon hallinta, Mittarit, Suorituskykymittarit

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Key Concepts and List of Abbreviations

CSA	Current State Analysis is a process management strategy used to identify, analyze and evaluate the current situation of an entire company or a specific process.
KPI	Key Performance Indicator is a metric that demonstrates how well the company or an individual performs an operational, tactical or strategic activity in order to achieve key business objectives.
BI	As a term Business Intelligence (BI) is very broad and it is used to describe more advanced methods and techniques of information management and software.
Dashboard	Dashboard is a graphical user interface that often displays the most important information on a single screen so the information can be monitored at a glance.
SQL	SQL stands for Structured Query Language and it is a domain-specific language used to communicate with databases.
SAP Business Warehouse	SAP Business Warehouse is a data warehousing platform that provides modeling tools that allow companies to collect structured data from both SAP and non-SAP systems and to model, analyze, and simulate individual business areas or the company as a whole.

1 Introduction

We live in a rapidly changing world, especially for business. Data is everywhere and the volumes of data are exploding. It is clear that data is becoming a key business asset that is essential for every business to succeed. As the world becomes smarter, data becomes the key to competitive advantage, which means that a company's competitiveness is increasingly driven by its ability to utilize data, apply analytics, and implement new technologies. (Marr, 2017)

Business data management has become an essential part of the company's product management. Effective utilization of data provides advantages for companies and helps them to make better decisions in business. Currently, the technologies are copied fast and developing a real product and service innovations seem to be increasingly difficult to make. Therefore, companies are nowadays competing how efficient the business is and who makes the smartest decisions. (Harris, 2007) In this, analytics help companies. In business, the role of analytics is to help to understand and analyze data and thus support decision-making by making different data analysis and predictive models. It aims to find out a solution to business issues, predict unknown outcomes, discover relationships and automate decisions that are difficult to do just by looking at data. (Harris, 2007)

According to Forbes article, the amount of digital data is growing faster than ever. In the last two years, the human race has generated more data than in the entire previous human history. Therefore, the utilization of business analytic services and tools is vital for companies. Those enable companies to analyze, verify, and disprove existing theories and models and in the best case, create competitive advantages. In order to manage, develop and maintain portfolios and products more efficiently it is important to utilize sales data by analyzing and visualizing it. For instance, these actions will help product managers in making better and more accurate decisions for the future. (Marr, 2015)

1.1 Business Context

This thesis was carried out for a multinational corporation that operates in the electrical industry. Currently, the company operates in multiple countries and employs thousands

of people globally. The company's operations focus on the areas of automation technology and electric power technology. (The company's website, 2020)

This study was conducted for the company's product management and especially its product managers. According to Steven Haines, product management is about managing products, product lines, or portfolios holistically to maximize value creation over their life cycles. This view is very well aligned with the case company's view of product management. The purpose of the Product Manager and especially its role at the company is to ensure that the products support the company's overall strategy and goals. Product managers support business results by supervising all steps in the product, system or service life cycle including development, launch, maintenance, pricing, and profitability. (The company's website, 2020)

1.2 Business Challenge, Objective, and Outcome

The following describes the business challenge, objective and intended outcome of this thesis.

The business challenge regarding this thesis is that the case company's product management does not have a shared dashboard that would be always up-to-date, easily available and which would measure accessories performance in different markets on a global level.

Currently, each product manager has exploited data by creating and preparing different kinds of metrics by themselves in various software tools such as Excel and Power BI. Learning to use well these kinds of programs is time-consuming unless you are already familiar with them because creating reports and dashboards requires a good understanding of data and good knowledge of visualization tools. Product managers simply have not had the time and enough skills to create a shared dashboard of accessories which would include standard or unified KPIs. Moreover, they have not had all the needed information from accessories sales available in order to build a shared dashboard that would cover all the sales data of the company at a global level. Therefore, product management has given the assignment to develop a pilot version of accessories sales performance dashboard which would be always up to date and help product managers and

management to track easily accessories sales performance in different markets. This is the main objective of this thesis.

The purpose of the dashboard is to visualize accessories sales performance by showing metrics and key performance indicators and thus bring insights out from the data in order to support managers in business decision-making. Moreover, it aims to increase the ability to make better decisions, improve operations, and monetize data.

The outcome of this thesis is a pilot version of accessories sales performance dashboard that is easily available, easy to use and up to date. This is achieved by utilizing best practices explored in the existing literature and collecting information from product managers and other leading specialists inside the company. The dashboard will be implemented among managers inside the product management.

1.3 Thesis Outline

The scope of this thesis is limited to developing a pilot dashboard version of accessories sales performance and choosing the most substantial KPIs and metrics for the dashboard by interviewing the end-users of this dashboard. This thesis focuses on measuring accessories sales in different markets that the company provides for its main products. This version would also be fully automated in such a way that it automatically updates itself by downloading information from the required systems as they update. This thesis does not focus on improving the company's IT infrastructure or data architecture. Additionally, this thesis does not focus on comparing various reporting tools. The data visualization tool that is used in this development project is Power BI.

This study was carried out by: (1) performing a current state analysis which includes a description of the current way to measure, visualize and utilize data. This was conducted by gathering information about products and accessories through internal channels and interviewing product managers and other leading specialists inside the company. (2) Gathering and analyzing data from literature regarding dashboards, metrics, KPIs, Business Intelligence and Power BI. (3) Developing a pilot version of the dashboard for the company. (4) Validating the pilot versions of the dashboards with the company's product managers. (5) Making a summary and conclusions of the study.

Furthermore, the study is written in seven chapters. The first chapter contains an introduction to the thesis. The second chapter describes the methods and materials that are used in this study. The third chapter focuses on describing the current state. Chapter four examines available knowledge and best practices of dashboards, metrics, KPIs, Business Intelligence and Power BI. Chapter five describes the key findings of CSA and available knowledge and best practices and then how report pages and the dashboard have been developed and what kind of metrics and KPIs are used. The sixth chapter validates the developed pilot versions of the dashboards which have been carried out together with the product managers. The last and seventh chapter is a summary and conclusion that contains an executive summary, thesis evaluation, and practical next steps and recommendations.

2 Method and Material

This chapter provides an overview of the methods and materials used on this study. This chapter consists of three sections that are: (1) Research design, (2) Project plan and (3) data collection and analysis.

2.1 Research Design

The figure below illustrates the research design of this study. Moreover, it visualizes three data collections stages, the main stages of the study, and the outcomes of each stage of this study.

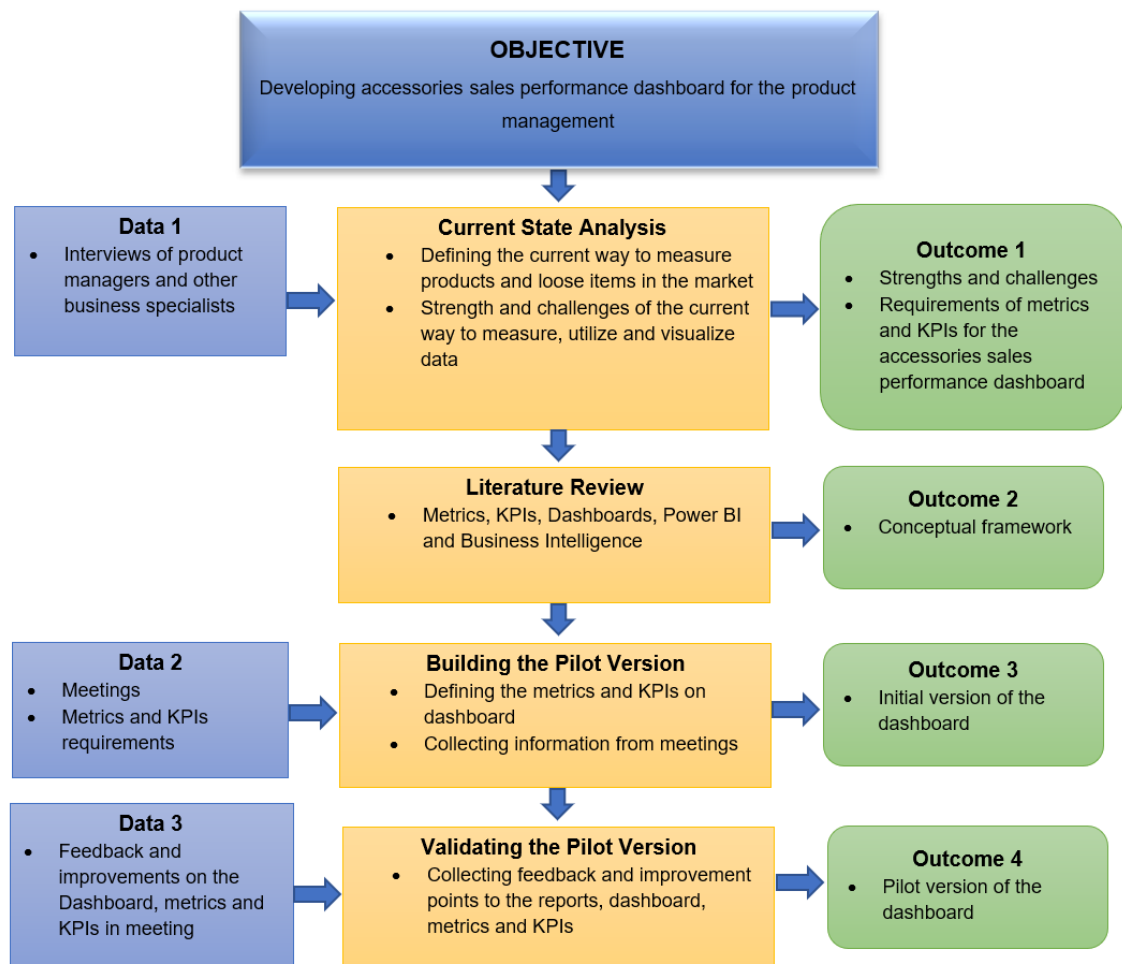


Figure 1. Research Design of the study

As displayed in figure 1 above, this study starts with describing the objective of the thesis. Next, the current way of measuring accessories in the market is investigated by interviewing product managers and the business analyst inside the company. The objective of this chapter is to demonstrate product managers' current ways to measure, utilize and visualize product data and highlighting its strengths and challenges in it.

In the next step, literature and available knowledge are examined, focusing on building knowledge regarding dashboards, business intelligence, Power BI, metrics and KPIs. The objective of this step is to collect knowledge of how a good dashboard looks like and gather relevant information from KPIs and metrics that can be later applied and utilized in the Data 2 step. The outcome of this chapter is to gather knowledge on these topics and thus to get an idea of what a good dashboard looks like and what it requires to make it easily available, easy to use and up to date for its end users.

In the next step, building the pilot version of the dashboard is initiated by organizing a meeting between the case company's product managers. The results and answers from individual interviews are analyzed and discussed in order to define common KPIs and metrics for the dashboard. This phase also gives everybody the possibility to learn and influence each other as everybody can see each other's' needs and insights.

This chapter contained also a meeting with the business analyst regarding the SQL database and Power BI because during this phase, data importing initiated from the SQL database. This was followed by data cleaning and modifying and processing to the required form in Power BI because imported data required a great amount of cleaning and rebuilding work in order to transform raw data into a form that enabled to build needed metrics, KPIs, reports and dashboard. The objective of this step is to build an initial version of reports and dashboard together with metrics and KPIs to Power BI. The initial version of the dashboard is based on the key findings of the literature, product managers key requirements and needs of KPIs and metrics that were collected via individual interviews and which were identified during a meeting. The key findings are described in section 5.2. The outcome of this step is a first version from the accessories sales performance dashboard that includes several reports which will be released among product managers in the company.

Finally, based on the feedback given by the product managers, the initial version of the dashboards is validated and small improvements to the dashboards are made. The objective of this step is to make the final enhancements to the dashboard, reports, metrics and KPIs based on the feedback received from the product managers, so it corresponds to their needs. The outcome of this step is the final pilot version of the dashboard with multiple reports which are made available to the entire product management staff of the case company.

2.2 Project Plan

This thesis was part of the Metropolia University of Applied Sciences bachelor's degree in the Industrial Management program. This development project was carried out for the case company from the beginning of January 2020 to the beginning of May 2020. The schedule of this thesis is described below.

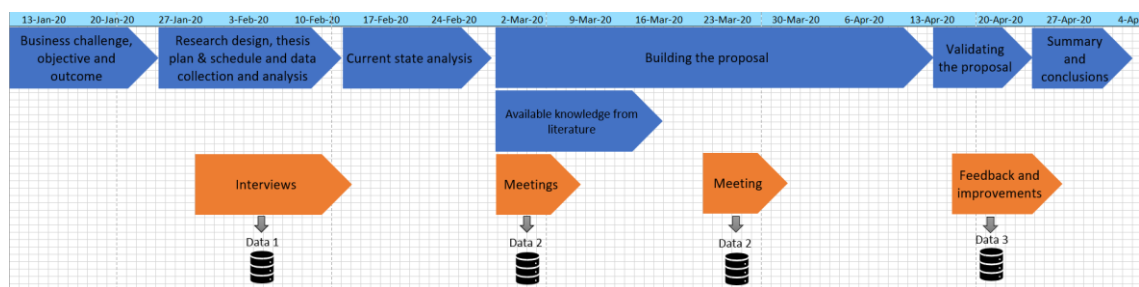


Figure 2 The schedule of the study

Figure 2 provides a weekly overview of the project progress. The total duration of this study was 16 weeks. The schedule in figure 2 was created based on the stages of the research design.

This study was part of a real-time business project commissioned by the case company. This project was carried out to support the case company's product managers in decision-making by measuring accessories sales performance in different markets. The data sources and analysis are described in more detail in the next section.

2.3 Data Collection and Analysis

The data for this study were collected in three different rounds by interviewing end-users and organizing meetings. The data collected was used for conducting the current state analysis, building an initial version of the dashboards and evaluating the initial version of the dashboard. The data collected for this thesis is shown in Table 1 below.

Table 1. Details of interviews, meetings and discussions

	Participants / Role	Data type	Topic, description	length	Documented as
Data 1, for the CSA (Current State Analysis)					
1	4 x product managers	Face-to-face Interviews	- Current state of the company regarding measuring, visualizing and utilizing data - Initial requirements for the metrics and KPIs	1 hour	Field notes
2	1 x business analyst	Face-to-face interview	- Current state of company's data architecture, software's and databases, dashboards and reports	1 hour	Field notes
Data 2, building process of the dashboard					
3	1 x business analyst	Face-to-face interview	- SQL Databases and Power BI	1 hour	Field notes
4	4 x product managers and supervisor	Common meeting face-to-face	- Metrics and KPIs requirements - Initial building plan for the dashboard	2 hours	Field notes
5	4 x product managers and supervisor	Common meeting via Microsoft Teams	- Visualizations and report pages - Initial version of the dashboard	30 mins	Field notes
Data 3, from validation					
6	4 x product managers	Microsoft Teams meetings	- Evaluation of the preliminary version of the dashboard and final enhancements	1 hour	Field notes

As shown in table 1 above, the data was collected in three different rounds. In the first round (Data 1), the data was collected to perform an analysis of the current state of measuring, utilizing and visualizing data among product managers. It was conducted by interviewing the company's product managers. Additionally, the business analyst of the company was interviewed as well in order to investigate the company's data architecture, software's and databases. In addition to the interviews, various internal documents were explored in the CSA stage.

The purpose of this round of data collection was to understand the company's current way to measure, utilize and visualize information and to identify the strengths and challenges of the company by creating a table from the strengths and challenges. The initial requirements of KPIs and metrics were collected during this round from the product managers in order to identify common and individual needs. Additionally, to get a general view of how data is managed and what kind of databases the company is using was performed as well during this round by interviewing a business analyst in the case company.

In the second data collection round (data 2) the data collection was performed to build an optimal first version of the dashboard for product managers. This data collection round was conducted with two meetings with the product managers and a meeting with a business analyst. The purpose of the first meeting with the product managers was to bring out each product manager's views of measurements collected on previous data collection round and thus reach a common understanding of the metrics and KPIs on the dashboard. The purpose of the second meeting with the product managers was to analyze the report pages created and the first version of the dashboard. The purpose of a business analyst interview was to understand better the data structure in the company, discover ways to build the dashboard, and ensure data quality and accuracy.

In the third and last data collection round (Data 3) the data was collected to validate the initial versions of the dashboards and to identify possible points for improvement. This was performed together with the product managers in separate meetings via Microsoft Teams.

In the next chapter, the current state analysis is carried out which describes more specifically the key findings of the CSA stage.

3 Current State Analysis

In this chapter, the product managers' current way to measure, visualize and utilize data in different markets is presented. First, an overview of this stage is provided. Second, a brief introduction of the case company's product management has been described. Third, the description of the current way to visualize, measure and utilize data among the product managers is presented by providing methods and tools that the company's product managers exploit. Fourth, a summary of key findings is described and presented in a table as strengths and challenges. Finally, challenges are identified in table 3 which addresses what kind of available knowledge and best practices are needed to study in the next chapter.

3.1 Overview of the CSA Stage

In order to gain a clear picture of the company's product management and the current ways how the product managers are measuring, visualizing, and utilizing data, the current state analysis was conducted through interviews and researching internal documents. The purpose of the current state analysis was to build an understanding of how the company's product managers measure and utilize product sales data and apply analytics in decision-making and thus point to development areas. As a result, strengths and challenges are described.

3.2 Background of the Product Management

In this section, a brief summary of the case company's product management and the product managers is described.

Product Management is a strategic function in the company, and it consists of usually three different roles such as product manager, project manager, and product marketing manager.

In the case company, the project managers' roles differ slightly, and they are part of the R&D organization. They are responsible for looking after the overall schedule of the projects given by the product managers. In daily work, the product managers come across

many topics. According to the case company's internal documents, the product managers are responsible for managing products, product lines, or portfolios holistically and they steer cross-functional teams to optimize market position and financial returns over the life cycle, based on market understanding, future trends, and alignment with business strategies. They follow products from the time they are conceived, to the time they are withdrawn from the market. In order to succeed in their job, they must work closely with the customers to gather feedback, requirements, and complaints so they can keep on track and predict market trends and this way develop existing and future products better.

3.3 Current Practices to Visualize, Utilize and Measure Data

According to the interviews, the case company's product managers have used Excel and Power BI to create their own dashboards or in fact reports, albeit everyone called them dashboards. They have exploited sales data of accessories, either by creating and preparing different metrics and KPIs by themselves or in some cases by someone else on their behalf. They have also used SAP Business Warehouse for fetching, creating and modifying data from SAP, in order to generate reports. When SAP Business warehouse has been used for fetching data, the data quality and reliability have not been fully valid for them because different countries use different terms and mark sales performances in different ways in the ERP-system. Also, in this way they have had to create multiple Excel pages before downloading them to Power BI since Excel cannot handle large amounts of data. Therefore, they have had challenges to use this raw data and create measurements and visualizations as they have not had enough time to focus on it or skills to clean the data to a form that would enable them to create comprehensive and reliable visualizations from the data.

Based on the interviews, every product manager has utilized some kind of dashboard, report, metric or KPI in decision-making to manage and develop their portfolio. Nevertheless, the current way how they are utilized, and measured data is limited to a certain amount of data. Consequently, none of the product managers have had global sales data available from accessories. This has led to a situation where it has been difficult for them to justify new and existing product development decisions fully to accessories sales data.

In addition to the interviews and internal documents, the case company does not seem to have a data management unit that would be directly focused on analyzing, modeling

and this way improving and managing the quality of sales data. Everything is done by the project-based way just like the next observation that came up in the meetings. The interviews revealed that many individual projects are currently underway to improve data quality and reliability. One of the projects was closely related to this thesis which aims to create an automated real-time database to SQL by collecting master data and products sales data from the company's various systems that can be used as a data source in the future and thus to create own dashboards easily in different units and teams inside the company.

3.4 Summary

The product management's main object is managing products, product lines, or portfolios holistically to maximize value creation over their life cycles and the product managers are responsible for this. In order to succeed in their job, they must work closely with customers and know the markets. They follow the product from the time it is conceived, to the time it is withdrawn from the market. Therefore, they need to have a good knowledge of their portfolios and knowledge of the sales of their products in different markets and countries, so they can keep on track and predict market trends and this way develop existing and future products better. Accessories sales performance dashboard will help them in this. It enables product managers to see things that normally they cannot see from individual customer visits, or discussions with sales organizations because the big picture of the global sales performance is missing.

Based on the interviews with the product managers, developing a shared sales performance dashboard of accessories by themselves has been a challenge to the people because either they have not had time to build it, or they have not had enough skills to do it or then they have not had access to all the necessary data in order to build a dashboard which would cover global sales figures from accessories.

However, the main challenge has been the availability of the necessary data. All the necessary data has not been available easily in the same place. Also, the case company has not standardized the way users or employees should record sales data in the system. Perhaps the company has some rules or standard ways to do it but due to the company's sales units and their structure and the way how they are responsible for their own profits and losses, this is not clearly standardized all the sales and business units.

This has caused problems for people who have not been familiar with the data or do not know the logic behind it or the right ways to transform it into the right format. Additionally, during a meeting with a business analyst, it turned out that the current order-system is handling orders in two different ways which have caused also issues and thus reduced the data quality.

In addition, metrics and KPIs between product managers are not unified or standardized in a way that would allow comparison at a glance and increase the consistency and continuity of measurements and thus improve the understanding of measurements. Currently, each product manager has their own views on the success factors of their portfolio. This is mainly due to the different nature and characteristics of the products.

Strengths

The interviews revealed that the case company has already an ongoing project that aims to develop an automated real-time database to SQL server by collecting master data and products sales data from the company's various systems. It turned out that this database was already quite far developed which meant that it could be utilized in this study. Therefore, this study ended up developing a pilot version of the accessories sales performance dashboard from this SQL database. It also provided data on global level, so this was a perfect database for this project considering the future. Additionally, it was also clear that one of the biggest strengths that the company has a great amount of expertise and know-how about Power BI that was already widely used inside the company.

Challenges

Currently, the challenge for product management and more specifically for the product managers has been to create a common dashboard from accessories sales performance on a global level. Since the dashboard should be in common use in product management and product managers should be also aware of their colleagues' products, the dashboard should also contain common metrics and KPIs. This would allow the product managers and management to easily monitor each accessories performance in different markets and increase the consistency and continuity of measurements. The obstacle or challenge in this has been that product managers simply have not had the time and skills to create a common dashboard themselves.

Moreover, the current ERP-system that the company is using, has not been standardized in a way that would make finding and using data simple and easy for everyone. For instance, different countries describe and name certain things differently in the system which has required a lot of data cleaning and processing work from users. They have had also challenges to obtain all the necessary sales data from different databases when they have tried to create their own dashboards. Therefore, data has often been incomplete because everyone's dashboards and reports have not contained the product sales data on a global level. This seems to be one challenge for the company because it is vital to have a clear database where all information can be found easily. Since this thesis does not focus on improving the data architecture of the information systems and databases itself, those aspects have not been analyzed in this thesis.

The challenge that comes with building the product sales performance dashboard from accessories is the way how the company marks accessories into the ERP-system. The sold accessories or features are shown in the data in two different ways, either plus codes or material codes. The plus code indicates that it is sold together with the main product and the material code that it is sold individually. The way how accessories sales are displayed in the system is simple to understand but they can contain many rules which naturally complicate the analyzing and visualizing part. For instance, some accessories come as a standard part of the product depending on product type and information from those are not marked to the data. In order to recognize these cases, it is needed to know the product's "exact model" that tells the product's exact model and specs. The challenge in this is that there are own rules in plus codes that complicate making visualizations and calculations from the sales data. So, in order to create a reliable dashboard from accessories sales figures, it is needed to know what kind of rules every accessory keeps inside and is it a standard part of the product or not.

Additionally, many countries have various own versions and ways to use the ERP-system which complicates sharing the data and thus data quality and reliability. Since the company does not have a standard way to mark and name data to the ERP-system similarly all over the world, it naturally affects data quality and the capability to analyze and visualize it. Table 2 below, summaries the key strengths and challenges of the current state analysis.

Table 2. Strengths and challenges table of the current state analysis

Strengths	Challenges
<ul style="list-style-type: none"> • Competence and knowledge inside the company • SQL Database what to use • Usage of Microsoft Power BI 	<ul style="list-style-type: none"> • Data quality and availability • Lack of time & lack of technical skills • How sold accessories are displayed in the data • No common metrics or KPIs inside the team • Excel and SAP Business Warehouse

Table 2 above, describes the key strengths and challenges of the CSA. It is a summary of the key findings from the current state analysis.

As seen in the strengths and challenges table, the case company has expertise and know-how to utilize Power BI inside the company. The already utilizing Power BI rather than Excel in some cases which is good because Power BI is ultimately the business analytics tool that provides much more capabilities than Excel. Power BI is an advanced version of Excel with a wider range of features to use and it allows the user to build much more complex data models easily. In section 4.2, Power BI is investigated in more detail and gives more insights into why Power BI is a much better solution for this project.

On the other hand, there are several challenges identified. For instance, data quality and availability have been a major obstacle for many product managers when they have created reports by themselves in Excel. Moreover, Excel and SAP Business Warehouse have been as a tool to import, modify and filter data to Power BI which has limited the amount and accessibility of data and thus reduced efficiency. Also, the lack of time and technical skills have played a big role in why they have not managed to create a common dashboard yet. Lastly, the way how sold accessories are showed in data is complex and it is not user friendly from the data visualization perspective. It requires much work to get the data into a format that would provide useful information about plus codes sales.

Moreover, the interviews revealed that one of the case company's projects was closely related to this thesis, which aims to create an automated real-time database for SQL by collecting basic data and product sales data from the company's various systems. It also turned out that it was already providing data at a global level. Therefore, this thesis ended up using this SQL database because it seemed the best solution for everyone considering the future. Additionally, it created a perfect basis for this thesis even though the SQL database was not fully ready.

Table 3. Identified challenges that will be explored in chapter 4. Available knowledge and best practices

Key findings from CSA	Reference in chapter 4	Purpose of explored knowledge and best practices
Product managers knowledge and competence to use Power BI Excel has been used to create reports such as pivot tables that is not the best option for large amounts of data (big data)	4.1 Business Intelligence 4.2 Microsoft Power BI 4.2.4 Dashboard, Report, Dataset 4.2.5 The key differences between Power BI and Excel	To strengthen the analytical knowledge about Business Intelligence (BI) To get basic knowledge about Power BI and how does it work and why it is better solution than Excel
Product managers does not have had a common or unified KPIs and Metrics inside the team.	4.3 Key Performance Indicators and Metrics 4.3.1 Metric 4.3.2 Key Performance Indicator	To get basic knowledge about KPIs and Metrics and why those are important in business and what is the difference between these two.

Table 3 above describes the key challenges that were chosen to be explored in the available knowledge and best practices in chapter 4.

Many challenges that the current state analysis revealed are already under development. Therefore, in the next chapter (4), available knowledge and best practices are focusing more on the usage of the Power BI tool and finding the most substantial metrics and KPIs for the dashboard and reports.

4 Available Knowledge and Best Practices on Dashboards, Business Intelligence, Power BI, Metrics and KPIs

This chapter covers the available knowledge and best practices of dashboards, reports, metrics and KPIs that are explored to develop the products sales performance dashboard. The purpose of this chapter is to help build a conceptual framework for this study which will be used in section 5 to build a pilot version of the dashboard. The first section focuses on describing business intelligence in general. The second section focuses on describing Microsoft Power BI. The third section focuses on metrics and KPIs. The final section presents and describes the conceptual framework.

4.1 Business Intelligence

As a term Business Intelligence (BI) is very broad and it is used to describe more advanced methods and techniques of information management and software. It covers the collection, management and reporting of information related to decision-making, as well as all related analytics and calculations used by the organization for the data analysis of business information. In simple terms, it can be described activities where the organization collects, analyzes, shares and utilizes relevant business information that is beneficial to its own operations. Its purpose is to transform raw data into meaningful and useful information that serves then business purposes and creates value for the organization. At its best, it acts proactively supporting decision-making and enables making better decisions and thus increases business in a more productive direction. (Harris, 2017)

Competitive advantage from business information

The information is not automatically valuable or creates a competitive advantage as such for the company. Information can be even more harmful than beneficial to an organization if the data collection is focusing more on quantity rather than quality and usability. Relevant and timely information can help an organization identify and analyze alternative solutions in a decision-making situation. Informed and reasoned decisions guide an organization's operations in a better direction and help it succeed better than its competitors. Therefore, it is important for a company to focus on providing relevant and useful information to reduce the risk of making bad assumptions and decisions in business.

This should be taken into account when building the dashboard. For instance, how relevant the data is and what kind of metrics and KPIs are useful for its users and in which form the information should be presented in order to produce the maximum value. (Yliopisto, 2013)

Data that can create value for the organization, is relevant to its user in terms of content and is available to the right person, at the right time, and in a usable format. In order to make it produce value, it must also be able to be interpreted correctly and have an impact on the decision-making that guides the organization's operations. (Yliopisto, 2013)

Analytics can be shared in four different analytics levels that are descriptive, predictive, prescriptive and autonomous. Nowadays, companies in many industries offer similar products and use comparable technologies and thus high-performance business processes are among the last remaining points of differentiation. Today, companies mostly compete for business efficiency and who make the smartest decisions, and analytical competitors wring every last drop of value from their business processes and key decisions. Figure 3 below describes these levels by questions. It helps companies to identify their current analytical maturity level and thus start to build their way to the top. For instance, moving from the prescriptive analytics towards predictive analytics can enable companies to see and reach problems before they arise. However, all the organizations do not have to be in the autonomous analysis stage, but they should be focused on moving away from the bottom of the figure. (Harris, 2017)

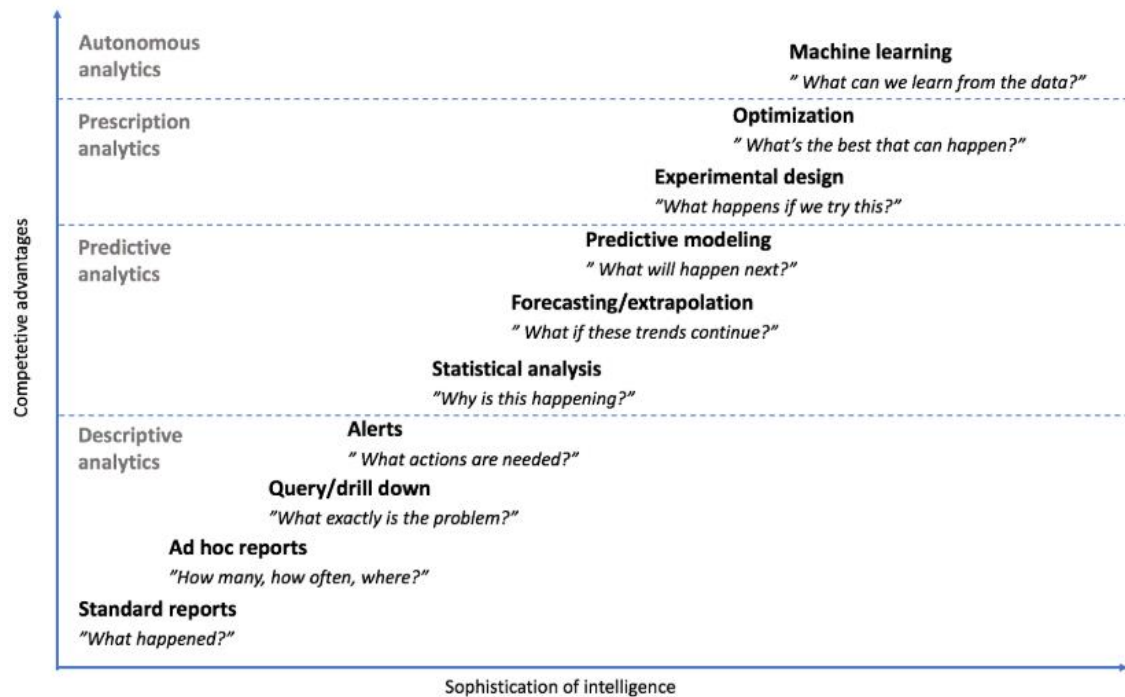


Figure 3. Analytical maturity level chart (Harris, 2017)

As figure 3 shows, analytics may be descriptive, predictive, prescriptive or autonomous. The vertical axis describes the competitive advantages level that field enables while the horizontal axis describes the intelligence and complexity level of that field. The horizontal axis represents a range of questions about an organization's business activities. The higher-level the question is, the higher level the sophistication of intelligence is. (Harris, 2017)

4.2 Microsoft Power BI

Power BI is a business analytics solution developed by Microsoft. It is a cloud-based data analytical and visualizing tool that allows users to monitor business performance and modify data easily. It was Microsoft's answer to the growing demand for BI solutions. They released it to the general public in 2015. The main function of the software is to enable users to create visual, interactive and real-time reports and dashboards. It allows user to collect different data sets easily from various sources, and then organize and visualize them. In addition, Power BI is a less technical-oriented business intelligence tool and it is user-friendly for beginners. Power BI consists of three main parts which are:

Power BI Desktop, Power BI service and Mobile apps. These three elements are designed to work together in a way that lets user create and share reports and dashboards from different business scenarios with others in an efficient way. (Microsoft, 2020)

4.2.1 Power BI Desktop

Power BI Desktop is a Windows desktop application. It is a free application to install on user's local computer that lets the user to connect, transform and visualize data. It allows the user to connect to multiple different sources of data and combine them into a data model and subsequently transform and clean data in power query editor. The data model lets the user build visualizations and thus to create reports and then share them with other people inside the organization. In Figure 4 below you can see the Power BI service view. (Microsoft, 2020)

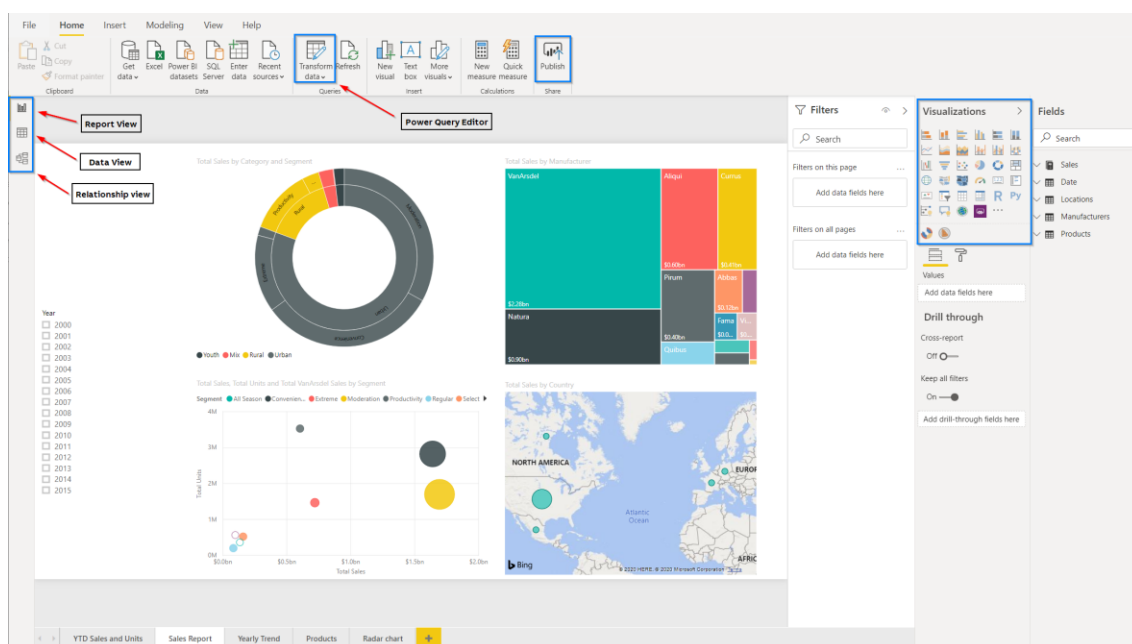


Figure 4. Power BI Desktop View

Figure 4 above depicts the Power BI Desktop view with three main views shown on the left side of the image. Those are (1) **Report**: In this view, the user creates reports and visualizations and there most of the users spend their time. (2) **Data**: This view shows all the tables, measures and other data that are used in the data model. (3) **Model**: This view is for seeing and managing relationships between different tables in the data model. The fourth marked view is **Transform data** that enables the user to clean and transform

data using the built-in Power Query Editor. With Power Query Editor, the user can make changes in the data, such as changing data types, removing rows and columns, creating new columns, or combining data from multiple data sources. The fifth marked view is **Visualizations**. Power BI includes several ready-made Power BI visualizations from basic simple column charts to histograms. These visualizations are available in the visualization pane of both Power BI desktop and Power BI service. The last marked view is called **Publish** that enables the user to share reports with others. It publishes the report to the Power BI service where the user can make it available to anyone who has a Power BI license. (Microsoft, 2020)

4.2.2 Power BI Service

Power BI service is an online SAAS (Software as a Service) service. Power BI service is used to share reports and dashboards with others. Models or Reports implemented with Power BI Desktop are published in the so-called workspaces on Power BI Service, where the most important metrics, KPIs and visualizations are compiled from reports to Dashboards. The five major building blocks of Power BI service are: dashboards, reports, datasets, workbooks and dataflows. In Figure 5 below you can see the Power BI service view. (Microsoft, 2020)

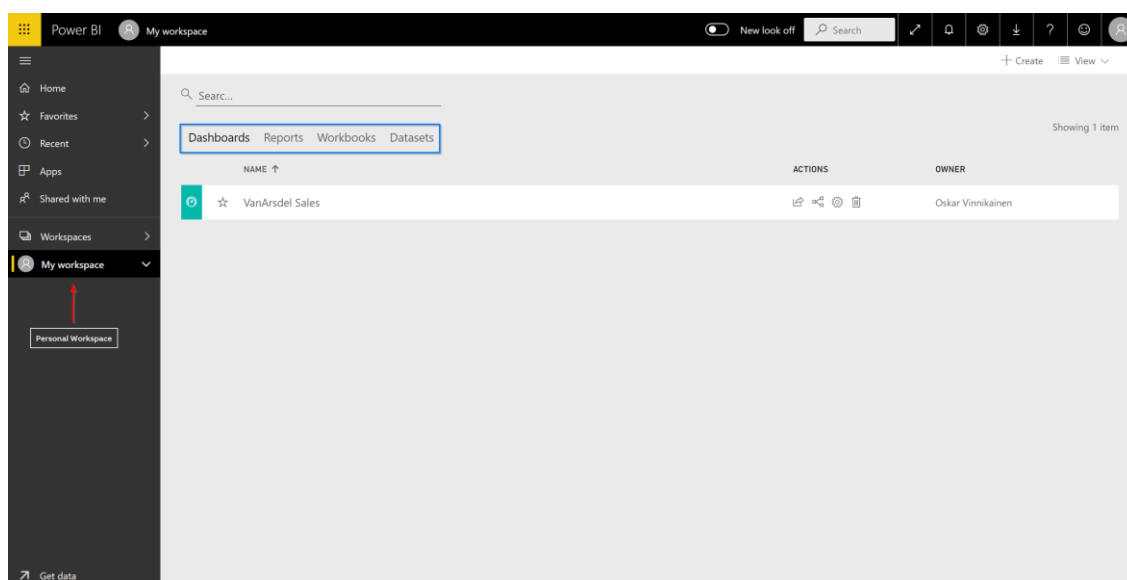


Figure 5. Power Bi service View

4.2.3 Power BI Mobile Apps

Power BI mobile apps are provided for Windows, IOS, and Android devices. In mobile apps, the user can easily view and interact with data that is published for him. The Power BI mobile app is mainly used by another coworker for instance, in sales, who can use the Power Bi phone app to monitor progress on sales metrics and KPIs on reports and dashboards. (Microsoft, 2020)

Summary of the advantages of Power BI

Power BI provides multiple advantages for its users. Some of the key benefits of Power BI are listed below.

- It provides a great way to monitor business and see all the most important metrics and KPIs at a glance.
- It is easy to use
- It enables to share dashboard and reports instantly
- It provides Q&A function that is easy and fast way to get an answer for your question
- It integrates seamlessly with existing applications and it allows to consolidate nearly any application or data sources such as Excel spreadsheets, SQL, GitHub, SharePoint, Google Analytics, Access, Websites and Salesforce
- It does not require specialized technical support
- No memory and speed constraints

4.2.4 Dashboard, Report and Dataset

Dashboard, reports and datasets play a key role in Power BI. Datasets are collections of data that the user imports or connects to the data model. The dataset/s form the basis

for data visualization, it includes data, tables, relationships, calculations and connection to the data source. Power BI allows the user to consolidate datasets from nearly any application or data sources such as Excel spreadsheets, SQL databases and websites and bring all of them together in one place and create a dataset. (Microsoft, 2020)

In Microsoft Power BI, dashboards are often mixed to reports which seem similar because both are canvases filled with visualizations, but those two are two different things. Dashboard is a graphical user interface that often displays the most important information on a single screen so the information can be monitored at a glance. It is a high-level view that consists of some key KPIs of one or more reports. Dashboard helps people to monitor and manage business performance. It provides the navigation point to the detailed reports. The purpose of the dashboard is to provide visualizations of the company's operations and often those are presented as Key Performance Indicators. The KPIs can indicate how well targets are reached or how well the product is performing in different regions or countries. (Steve Wexler, 2017)

According to Stephen Few (2013), the dashboard does its primary job if it tells you with no more than a glance that you should act. In terms of functionality, the main goal of dashboard is gaining the ability to extract important insights at a quick glance. However, if the viewer must scroll around to see all the information, it is no longer a dashboard. In order to create dashboards that create value for the users, there are several elements that should be focused. (Few, 2013)

First, the purpose and the end goal of the dashboard must be known. To do so, it is important to understand who the end-users are and identify what data are required by users. (Eckerson, 2010)

Second, the dashboard should provide accurate and beneficial content for its users. It is important to choose relevant KPIs and metrics because inaccurate and not beneficial visualizations and metrics can lead easily to bad and wrong decision-making. (Durcevic, 2019)

Third, do not try to place all the information on the same page. There can be multiple people who are using it and they may have different needs, and therefore it is often better to divide the information into different pages such as based on specific subject, industry, business unit or employee's role. When each role is provided with its own dashboard,

the needs for making the dashboard too complex is minimized because you probably do not have to use filters, tabs or drilldowns on every page. This helps users find out important information much faster and easier. (Durcevic, 2019)

Fourth, make it as easy as possible to use and understand. In terms of best practices in design, accessibility is one of the most important principles. Dashboards must be designed with a clear sense of purpose. If visualizations on the dashboard are too complex to understand, users probably spend much more time on data analysis than they would without the dashboard. When designing the dashboard, it is important to keep in mind what kind of information the user is looking for. Putting yourself in the user's perspective will help in designing a dashboard. (Durcevic, 2019)

Fifth, it is important to use the right type of chart. It is important to understand what type of information you want to convey. For instance. Choose (1) basic area chart when you want to see and compare the volume trend across time series. Choose (2) the bar chart when you want to compare items fast and easily in the same category such as sales per country or sales per product. (3) Pie charts can be very useful to visualize the high-level data such as total sales by regions or total sales by product groups. (4) Sparklines are useful and handy to illustrate trends because they are compact and do not require much space. (5) Waterfall charts are useful when you want to audit the main changes that are affecting to the total value or how much money each customer segment has made. (Microsoft, 2020)

Sixth, using interactive elements such as drill downs and filters. A comprehensive and good dashboard allows you to dig deep into certain metrics, insights and trends easily. (Durcevic, 2019)

Last but not least, never stop development. It is very important to keep developing the dashboard according to the changes around you to ensure continued analytical success. By asking for regular input from your team and asking the right questions, you will be able to improve the layout, visualizations, functionality and KPIs of the dashboard and thus always ensure its optimal value. (Durcevic, 2019)

A report, on the other hand, is just any informational work and it can be in any format, for instance, table, text, number, chart, etc. In Power BI, a report is a combination of several visual elements on a page that can be related to each other. (Rad, 2016)

In simple terms, the difference between dashboard and report in Power BI is that dashboard contains only one page and it consists of one or more reports and datasets while reports have one or several pages and it has a single dataset per report. One way to think about this is that Dashboard is some sort of entryway to the reports and datasets. When you click a visualization on the dashboard, it will take you the report it is based on. (Microsoft, 2020)

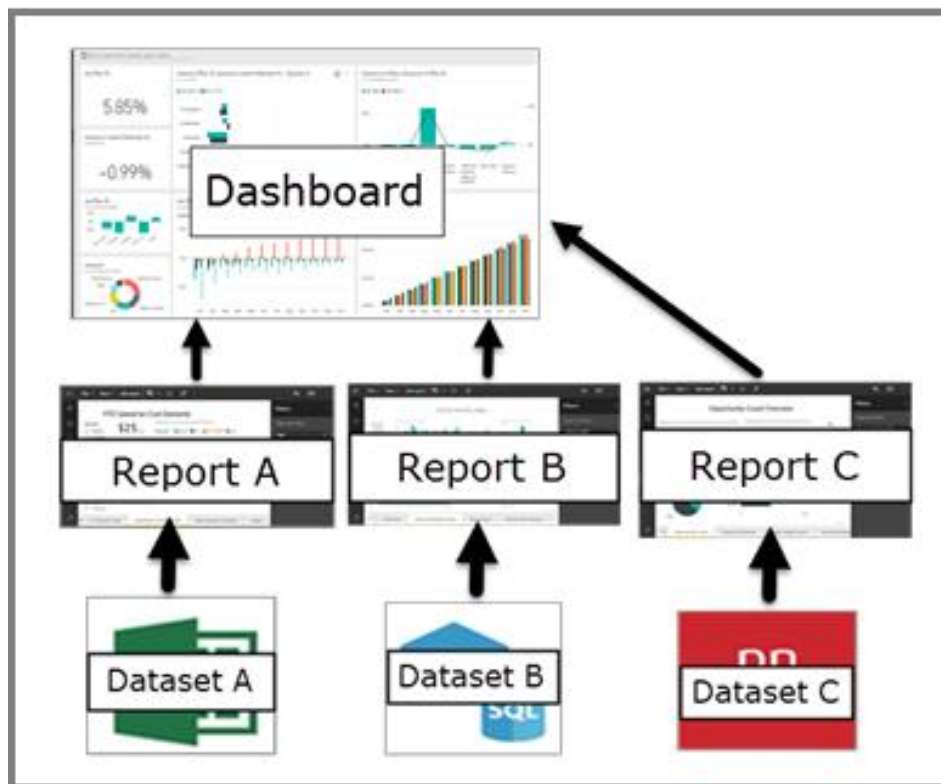


Figure 6. Dashboard, Report and Dataset

As Figure 6 above illustrates, the dashboard can consist of multiple reports and datasets while the report contains only one dataset.

4.2.5 The Key Differences and Advantages of Power BI and Excel

Microsoft Excel is an office 365 product from Microsoft. Power Bi is a business analytics solution developed by Microsoft. It is a cloud-based data analytical and visualizing tool that is intended for creating interactive dashboards when Excel is a spreadsheet application that is used to run smaller data analytical and mathematical calculations and organizing data. Power BI used to be at the beginning a Microsoft Excel-based add-in, but

it developed quite rapidly into a separate entity. It was Microsoft's answer to the growing demand for BI solutions. However, the software is still very strongly linked to Excel, although it still has significant differences to Excel. (Educba, 2020)

Below are listed some of the biggest key differences between Power BI and Excel. (Educba, 2020)

- Power BI is much faster in processing data and a more powerful tool than Excel
- Power BI can handle big data while Excel cannot
- Power BI is easier to use and more user friendly with mobile devices. It allows users easily to monitor dashboards and reports
- Power BI allows its user to create interactive and custom dashboards while Excel is limited features to build up reports

4.3 Key Performance Indicators and Metrics

In this section, the literature on KPIs and metrics are examined in order to gather available knowledge and best practices on them. In addition, the difference between metric and KPI is investigated. Every manager knows that KPIs and metrics are important in business. The problem is that often people do not understand why they are important and what is the difference between these two. Metrics and KPIs are described in more detail in the following two sections.

4.3.1 Metric

If it cannot be measured, then it cannot be managed. Metrics keep stakeholders informed of the current situation. Metrics are nothing more than a measurement you record to track the success or failure of your business activities. Metrics allow you to analyze the results and show how well the actual activities are performing in relation to a set target. In simple terms, metrics generally focus on achieving the performance, focusing on the current moment. (Kerzner, 2016)

Good metrics provide several benefits.

- Good metrics support decision-making
- Good metrics can assess more accurately failure and success
- Good metrics improve performance in the future
- Good metrics allow managers to identify and mitigate risks
- Good metrics can improve customers satisfaction

However, it is required to understand the need for metrics because poor and inaccurate metrics can lead in bad decisions and failures. Therefore, metrics require a need or purpose and some target, baseline or reference point which is meaningful. It is more important that the metric is meaningful rather than the target is easy to achieve. Metrics require also means of measurement and interpretation. Additionally, it requires a reporting structure in order to provide useful information and support proactive management. (Kerzner, 2016)

Typical business-based metrics are:

- ROI (Return of Investment)
- NPV (Net Present Value)
- Profitability
- Market share
- Future opportunities
- Sales growth rate.

4.3.2 Key Performance Indicator

A Key Performance Indicator or KPI is a measurement. KPIs are used by individuals and organizations to assess their success at achieving critical targets. KPIs provide information for managers and stakeholders that is needed for decision-making.

According to Wayne W. Eckerson, a Key Performance Indicator is a metric that demonstrates how well the company or an individual performs an operational, tactical or strategic activity in order to achieve key business objectives. KPIs are high-level views of how a project or product is progressing toward predefined targets. (Kerzner, 2016) Similarly, Bernard Marr states that KPIs provide a way to measure how well organizations, business units or individuals are performing regarding their business objectives and strategic targets. In simple terms, KPIs focus on future outcomes and indicate where we will end up. (Marr, Bernard, 2019)

Key characteristics

The most important attribute of a KPI is that it is actionable. If the trend of the metrics is unfavorable then the user should know what necessary actions to make in order to correct the unfavorable trend. This means that the user must be able to control the outcome. Therefore, KPIs must be based on controllable factors. Wayne Eckerson has identified a set of characteristics for KPIs. Table 4 below describes Wayne Eckerson's 12 characteristics of effective KPIs. (Kerzner, 2016)

Table 4. Key characteristics of effective KPIs

1. Actionable , KPIs that allow users to intervene to improve performance in time
2. Simple , KPIs should be easy to understand, not complex visualizations that confuse it users. Users need to know what is being measured and how to affect it positively.
3. Strategic , KPI focuses on the outcome you want to achieve
4. Relevant , KPIs have natural life cycle so they must be periodically reviewed and refreshed
5. Aligned , KPIs should be always aligned to organizations strategy and objectives
6. Owned , Every KPI must be "owned" by an individual or group where is someone who accountable for its outcome
7. Timely , KPI is updated frequently so performance issues can be reacted as soon as possible if needed
8. Reinforced with incentives , KPIs will have a better impact once they are combined with incentives
9. Accurate , KPI can be measured and reported with reasonable accuracy
10. Correlated , KPI can be used to achieve desired business outcome
11. Predictive , The KPI can predict the future of this trend
12. Standardized , KPIs are based on standard definitions, rules and calculations so they can be used across dashboards throughout the organization.

Table 4 above describes the 12 key characteristics of effective KPIs that should be considered when defining and choosing KPIs. Their holistic nature will guide you in your quest to create the most effective KPIs possible. It is also worth noting that these key characteristics are more appropriate for business-oriented KPIs than project-based KPIs.

4.3.3 Key Difference Between Metric and KPI

The difference between metrics and KPIs is quite simple as metrics are used to track the processes when KPIs are used to track whether the business objectives have been achieved. Consequently, KPIs are strategic measurements that are measurable when metrics are tactical measurements that are measurable. Metrics support KPIs and KPIs support the overall business strategic objectives. (Hatheway, 2016)

4.4 Conceptual Framework

The purpose of available knowledge and best practices in chapter 4 was to use them to build a conceptual framework for this study. The conceptual framework is shown in Table 5 together with the key findings from the current state analysis.

Table 5. Conceptual Framework of this study

Key findings from CSA	Related theory	Reference in chapter 4	Purpose of explored knowledge and best practices
<ul style="list-style-type: none"> - Product managers knowledge and competence to use Power BI - Excel has been used to create reports such as pivot tables that is not the best option for large amounts of data (big data) 	Business Intelligence and maturity levels of intelligence (Competing on analytics) Business analytics tool (Power BI)	4.1 Business Intelligence 4.2 Microsoft Power BI 4.2.4 Dashboard, Report, Dataset 4.2.5 The key differences between Power BI and Excel	To strengthen the analytical knowledge about Business Intelligence (BI) To get basic knowledge about Power BI and how does it work and why it is better solution than Excel
<ul style="list-style-type: none"> - Product managers does not have had a common or unified KPIs and Metrics inside the team. 	Metrics and Key Performance Indicators on Dashboards	4.3 Key Performance Indicators and Metrics 4.3.1 Metric 4.3.2 Key Performance Indicator	To get basic knowledge about KPIs and Metrics and why those are important in business and what is the difference between these two.

As shown in table 5. above, the conceptual framework was built to tackle the challenges revealed by the CSA in order to build the initial version of accessories sales performance dashboard. Therefore, the available knowledge and best practices regarding BI, Power BI, metrics, KPIs and dashboards were investigated. The purpose of this was to increase the level of understanding of these topics and thus utilize the knowledge and best practices to build the initial version of accessories sales performance dashboard. In the next chapter, the building stages of the dashboard are described.

5 Building Accessories Sales Performance Dashboard

This chapter describes the stages of building the initial version of the dashboard for the case company. First, this chapter introduces the overview of building the initial version of the dashboard and the steps that were needed for that. Second, introducing the key findings of the CSA and conceptual framework. Third, the initial version of the dashboard and the sections that were needed to build it is described.

5.1 Overview of Building the Initial Version of the Dashboard

This section is an overview of the initial version of the dashboard and the purpose of this section is to describe the stages and the logic of building the initial version of the dashboard for this study. The initial version of the dashboard was built in four steps. The stages are illustrated in Figure 7 below.

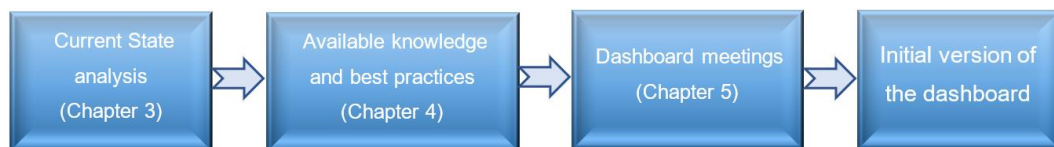


Figure 7. Stages for building the initial version of the dashboard

As shown in the figure above, the initial version of the dashboard was built in four phases. First, the current state analysis (Chapter 3) was carried out by interviewing the company's product managers and a business analyst and examining internal documents. The key findings from these are presented as a strengths and challenges table below.

Table 2. Strengths and challenges table of the current state analysis

Strengths	Challenges
<ul style="list-style-type: none"> • Competence and knowledge inside the company • SQL Database what to use • Usage of Microsoft Power BI 	<ul style="list-style-type: none"> • Data quality and availability • Lack of time & lack of technical skills • How sold accessories are displayed in the data • No common metrics or KPIs inside the team • Excel and SAP Business Warehouse

Table 2. above describes the strengths and challenges of the company's current way to measure, utilize and visualize data among the product managers. More detailed information about strengths and challenges are described in chapter 3. The CSA enabled the identification of the relevant areas in the literature (Chapter 4).

Second, available knowledge and best practices were explored based on the key challenges that were found in the current state analysis (Table.5 Conceptual Framework). Once all the required available knowledge and best practices to build the initial version of the dashboard were explored, the building process of the dashboard started.

Third, at the beginning of the building process of the initial version of the dashboard, a meeting with a business analyst was also held to get started with the SQL database and make sure that everything works. After that, two dashboard meetings were held with the product managers. The first one was to share findings from the CSA phase and evaluate the initial needs and requirements of metrics and KPIs that were collected in data 1 step, and then select the most optimal metrics and KPIs and then determine a schedule for the building process of the dashboard. The second one's purpose was to evaluate visualizations and report pages and the initial version of the dashboard. Finally, based on all these steps, an initial version of the dashboard for the study was built. Next, the building process of the initial version of the dashboard is described.

5.2 Building the Initial Version of the Dashboard

In this section, all the steps that were needed to build the initial version of the dashboard for the product managers are presented. It consists of multiple entities that are (1) Review of metrics and Key Performance Indicators (2) Connecting to data source (3) Preparing data (4) Creating reports (5) Publishing the reports to Power BI Service (6) Creating dashboard.

5.2.1 Review of Metrics and Key Performance Indicators

During the first meeting in data 2 stage, it turned out that all the requirements regarding measurements that the product managers wished during the interviews, were actually metrics although monthly and annual sales quantity comparisons were in fact key performance indicators, but any target values were not set for them at this stage. After that, it was clear that the product managers did not have any real key performance indicators at this point. The reason behind this was that the product managers have not previously had any measurements of the accessory's sales performance in a global level and because of this, they first wanted to see basic metrics about their products such as the total sales volume and total sales revenue of their portfolio's products. Therefore, all the measurements on the dashboard were designed as wished by the product managers. Later, when everything is built and everybody can see the sales volumes and the performance of the products in their portfolio, the future objectives of the current measurements can be considered in more detail. At this point, it was enough for each product manager that metrics and also a few KPIs that can be found in table 7 are sufficient measurements for this thesis.

During the common interview session, an effort was made to get on a common understanding of what are the common measurements that everybody wants to see on their reports and in the end on the dashboard. All the wished requirements of measurements were firstly analyzed and then clarified and finally, it was decided what would be measured in the dashboard. The purpose of this was to make sure that everybody understands the purpose of every measurement and what it means in practice.

Once everyone's needs and requirements about metrics and KPIs were analyzed, clarified and discussed, the chosen metrics and KPIs were documented. A list of metrics and KPIs that were chosen in the meeting are presented in table 6 below.

Table 6. Selected metrics and KPIs

Metric	KPI
Average Price per Loose Item, per Country	Current Month Sales Quantity versus Last Month Sales Quantity
How Many Products are Sold per Organizational Level	Current Year Sales Quantity versus Last Year Sales Quantity
How Many Products are Sold per Channel	
Average Revenue & Average Cost & Profitability	
Sales Quantity & Revenue per Customer	
Sales Quantity & Revenue per Product Type	
Sales Quantity & Revenue per Country	

Table 6 above presents the metrics and KPIs that were selected to be in the dashboard during the common meeting session with the product managers. These are straightforward measurements from raw data, and therefore these do not yet provide deep insights about the products in their portfolios. Therefore, more measurements need to be created in the future in order to get deeper insights.

5.2.2 Connecting to Data Source

During this section, connection to the SQL database was initiated. It started with opening Power BI Desktop and then clicking the get data button in the Home tab view and then choosing the SQL server option. (See Figure 8.)

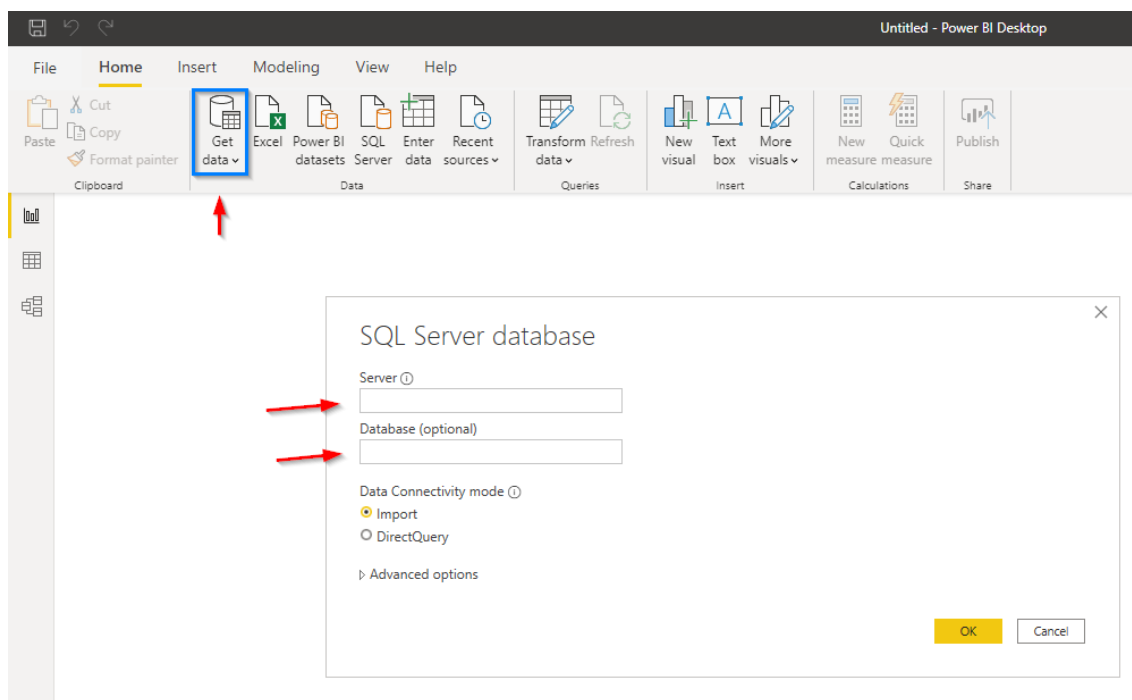


Figure 8. Connecting to the SQL database

As shown in figure 8 below, a pop-up window opened where the server name had to be filled and ensure the import option was chosen in data connectivity mode before clicking ok. After the connection was created, data preparation began.

5.2.3 Preparing Data

After the data was imported from the SQL server, data preparation began. This was the most time-consuming part of the whole study as the data was not in the form it should be in order to form the measurements and visualizations requested by the product managers. Moreover, the current database which was in the SQL server and used in this study, was still in progress, which meant that much more work had to be done in order to prepare data to the form it should be. The reason why this database was chosen for this study was that it already provided data on a global level. This solved the problem of data availability, so this was a perfect database for this project considering the future. Moreover, in the future, when this same database is completely ready, it will not require much work to rebuild these visualizations and reports again even if the structure of this database would change significantly because all the needed information regarding product managers' needs and requirements, data preparation, visualizations and reports are recorded and documented.

Additionally, most of the problems at this stage were due to the way the accessories sales information is displayed in the data. As was mentioned in section 3.4 that accessories sales are sold and displayed either as a plus code or material code. The way how plus codes are displayed in the data is quite complex from the data visualization point of view because it is shown together with all the other plus codes and with the main product. Therefore, before it was even possible to do any kind of visualizations from plus codes sales performance, new columns had to be created for every different plus code type. These columns were created in the Power Query Editor in a way that shared every plus code name to its own column because one order usually consisted of the main product itself and multiple plus codes and all this in one row.

Figure 9 below illustrates one of the many data preparations steps that had to be done in this phase.

```

if Text.Contains([OrderCode], "+ABC100") then "Product Type 1" else if Text.Contains([OrderCode],
"+ABC101") then "Product Type 2" else if Text.Contains([OrderCode], "+ABC103") then "Product Type 3"
else if Text.Contains([OrderCode], "+ABC104") then "Product Type 4" else if Text.Contains([OrderCode],
"+ABC105") then "Product Type 5"

else if Text.Contains([OrderCode], "Product Family 1") and Text.Contains([OrderCode], "+ABC106") then
"Product Type 6" else if Text.Contains([OrderCode], "Product Family 3") and Text.Contains([OrderCode],
"+ABC110") then "Product Type 7".....else null

```

Figure 9. Data Preparing step

As shown in figure 9 above, the "OrderCode" illustrates in this case a column of a long text string where the plus code had to be removed in order to calculate their total quantity. As usual, raw data itself rarely provides valuable information to companies. Therefore, it is almost always necessary to clean and prepare the data to the form that enables developers to build metrics and visualizations and thus generate value for its end-users. The following section 5.3.4 describes how report pages are created and how they look like.

5.2.4 Creating Reports

In order to build a dashboard, it is required to build report pages first and then pin live tiles to the dashboard interface. Therefore, multiple report pages and visualizations had to be created before it was possible to create any dashboard.

In this study, three different report page templates were created at first. The purpose of this was to provide a starting point for the structure of the report pages which would help to start visualizing and illustrating the data. These same layouts ended up also for the actual report pages, which are presented next.

(1) The front-page report view covers information from both ways to sell accessories which were either with plus code or with material code. (2) The plus codes report page view that covers all the sales that are made via plus code. (3) Loose Items report page view that covers all the sales that are made via material code. The reason to share this for three different pages was simple. This helped to reduce visualizations and KPIs amount in report pages and thus improve every report page layout and make it more user friendly and easier to understand from the end-user point of view. Additionally, another reason was that this enabled to implement product managers individual requirements of visualizations and KPIs much easier. It is also worth noting that all these three layout models are not exactly the same in all the report views because the products of the product managers were very different, so were the needs. Therefore, at this stage, 10 pages were created for four product managers and their products to meet all requirements. Next, three earlier described report pages are presented that are based on report pages of one product manager.

The first-page view is called the front-page view (see figure 10 below). All front-page reports include common filters which can be found on the right side of figure 10. Those are: year filter, month/year filter and product type filter.

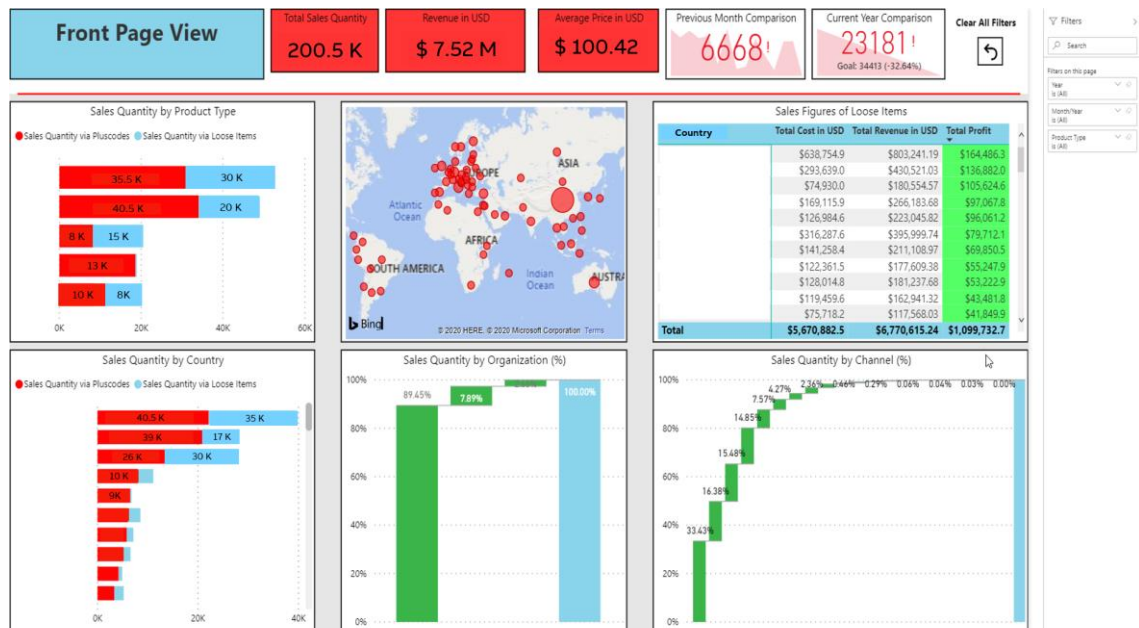


Figure 10. Front page report view

As shown in figure 10 above, the front-page view is designed in a way that the top bar shows single numbers such as sales quantity, sales revenue and the average price of products in USD. They are presented as card visual that is usually used to show single numbers what user want to track, such as total sales or market share. The other two visualizations in the top right corner are the previous month comparison which is comparing current month sales to the previous month and the previous year comparison which is comparing this year's sales to the last year's sales. These two are created using a visualization called KPI, which is usually used when user wants to measure progress or measure the distance to a target. All these visualizations provide a quick look to the most important numbers directly and easily at a glance.

The table in the middle right presents some sales figures. This allows the user to see easily total costs, revenues and profits in USD by country. The tile below that is called sales quantity by channel which allows the user to see the percentage of how many accessories each sales channel has sold. This is visualized by a waterfall chart that fits perfectly to display this kind of information. On the left side of that is a tile called sales quantity by the organization. This is also visualized by a waterfall chart and this allows

the user to see each product group's sales quantity as a percentage. The main purpose of this page is to compare the sales of plus codes to sales of loose items.

However, because every product manager had slightly different needs and requirements, some of the front-page views contain different visualizations and filters but the basic layout is almost the same in everyone's front page view.

The second page is the plus codes report view (See figure 11 below). All the plus code report views include common filters which can be found on the right side of Figure 11. Those are: year filter, month/year filter and product type filter.

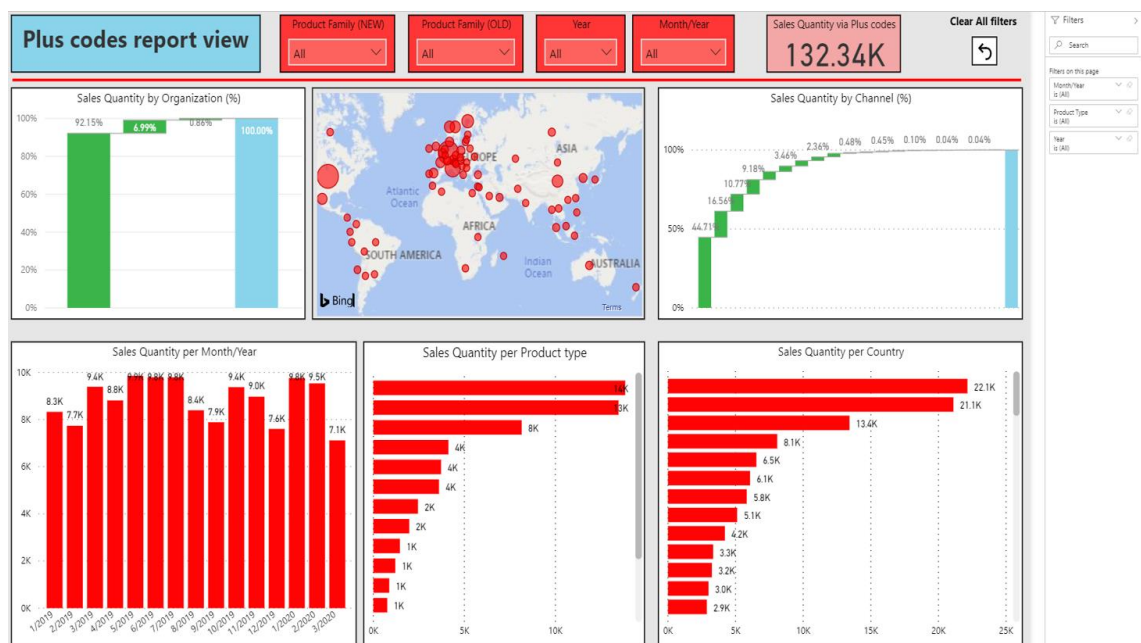


Figure 11. Plus codes report view

As figure 11 shows above, it is following a slightly different pattern than the front-page view. The top-level contains several filters and one simple single number visualization that represents accessories total sales quantity that are sold via plus code. This page contains also a basic column chart from sales quantities per month/year and basic bar charts from sales quantities per product type and sales quantities per country. These two visualizations are usually used to provide simple information on sales quantities. In addition, sales quantities by different channels and organizations are presented also on this page using a visualization called a waterfall that fits perfectly to display this kind of information.

The third and last report page view is called loose items report view (see figure 12). All loose items reports include common filters which can be found on the right side of figure 12. Those are: year filter, month/year filter and product name filter.

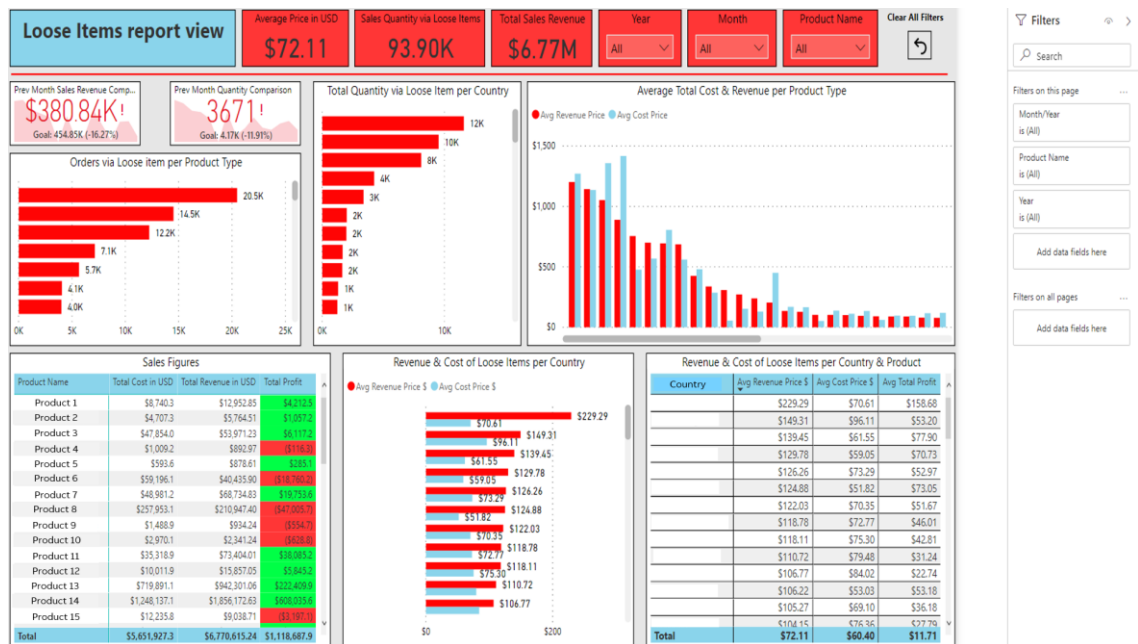


Figure 12. Loose items report view

As shown in Figure 12 above, it is following the same pattern as the previous two pages where the top bar consists of single numbers and filters. This report page is also showing basic sales figures of products which can be found from the bottom left corner. To the right of the sales figures, the revenue and the costs of loose items per country are shown in a clustered bar chart which is used to display more than one data series in the same column. In the table in the lower right corner, these same numbers can be viewed even more closely and extensively because this contains hierarchies in two levels that allow using the drill up / drill-down function. This table shows the average revenue price and average cost price of each product by country. More information about this visualization and a few others is presented and explained in more detail below.

Visualization 1. Revenue and cost of loose items per country

Name	Avg Revenue Price	Avg Cost Price	Avg Total Profit
Spain	\$84.42	\$55.32	29.10
Product 2	\$103.03	\$48.83	54.20
Product 5	\$94.71	\$71.40	23.31
Product 1	\$64.81	\$48.23	16.58
Product 4	\$65.20	\$55.74	9.46
Product 3	\$29.97	\$23.63	6.34
Germany	\$91.52	\$66.31	25.22
Product 2	\$89.99	\$48.78	41.21
Product 1	\$105.31	\$72.32	32.99
Product 4	\$96.68	\$71.22	25.47
Product 5	\$71.94	\$55.74	16.20
Product 3	\$61.69	\$48.22	13.46
China	\$52.46	\$39.37	13.09
Total	\$64.17	\$59.73	4.44

Figure 13. Revenue and Cost of loose items per country

As Figure 13 above shows, this describes average revenue prices, average cost prices and thus average total profits in different countries per product. This visualization includes hierarchies in two different levels where the country is the higher level and product name lower level. This allows the user to utilize the so-called “drill up / drill down” functions in Power BI which can be found when user hover your mouse over a particular visualization.

This visualization allows the user to easily see how much profit each country is making per product and see if the average selling prices in different countries differ and thus to discover more information about the sales strategies of different countries. Moreover, this allows the product managers to compare those prices to the total average price and thus detect potential products or industries which need support from the product managers. This also improves the working efficiency of the product managers because they can easily monitor products’ performance and benchmark different countries and see important information at a glance without contacting local sales units of different countries.

Visualization 2. Total cost vs revenue

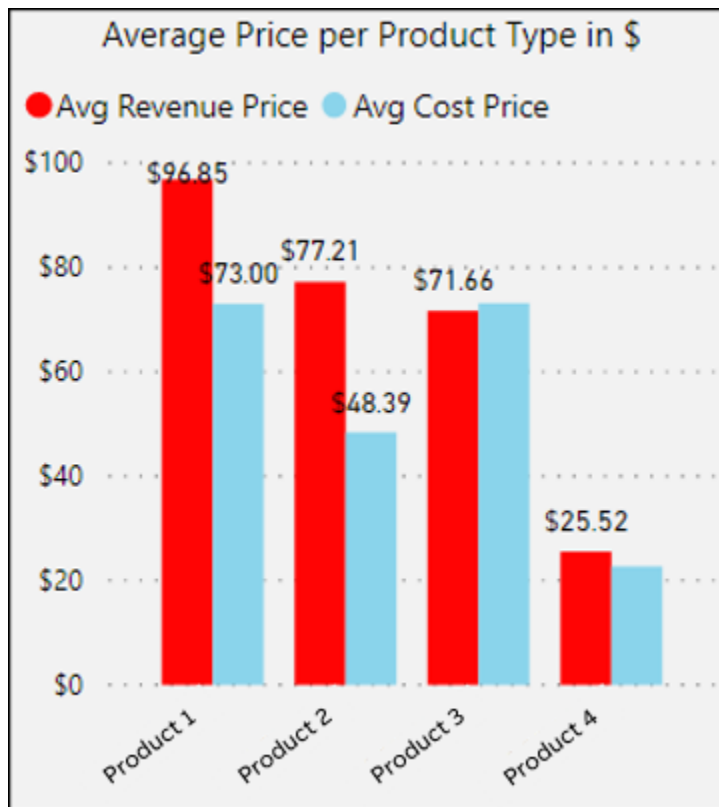


Figure 14. Average Price per Product Type

Figure 14 above compares each product types' average revenue price to average cost. This is because every accessory type might have a different purpose such as some of the products sell less than others, but they are in the market making a huge profit. Therefore, it is useful to have this kind of measurement which allows the product manager to see at a glance how much money each accessory type earns and how much each accessory type cost averagely. This also allows the user to react quickly to problems that require improvements because as a product manager, maintaining each product strategy to maximize the total profit is a challenging task.

Visualization 3. Sales quantity by product type

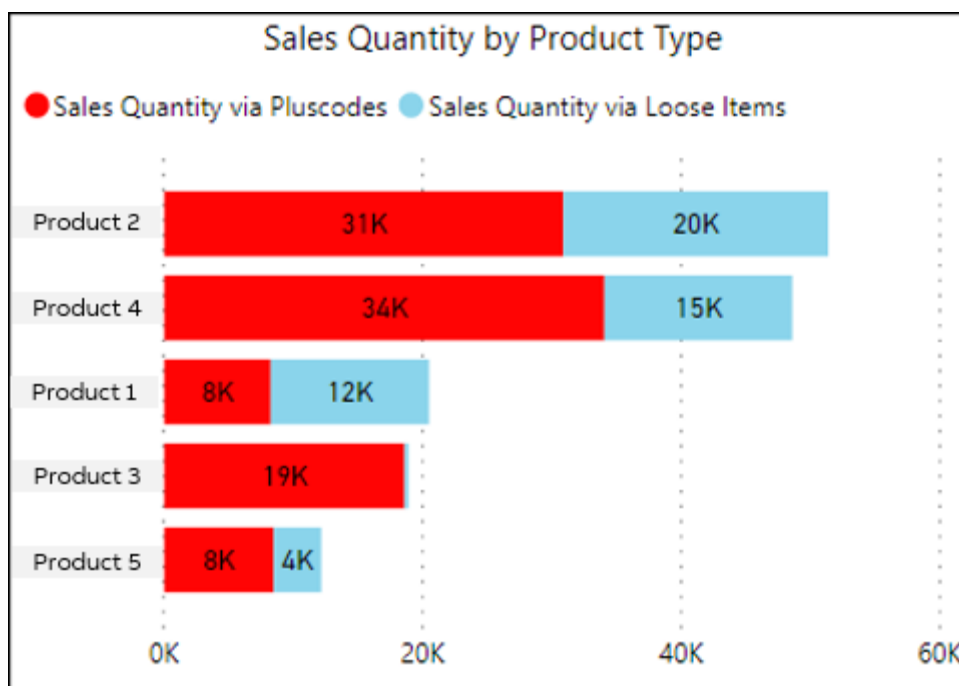


Figure 15. Sales Quantity by Product Type

Figure 15 above illustrates the sales volumes of the top five products and the way the product has been sold. This is visualized by a stacked bar chart. This allows the user to easily see his top 5 selling products and the way they have been sold.

Now that three report pages are built and a few visualizations are described and presented, the next step is to publish all the reports to Power BI service to build the dashboard.

5.2.5 Publishing Reports to Power BI Service

Once the reports were complete, the dashboards could be created. However, dashboards could not be created on Power BI desktop since Power BI desktop is unable to support dashboard functions. Therefore, it had to be "published" first to the Power BI service, where reports can be seen in a so-called my workspace where reports can be

used to build dashboards and share them with coworkers. Figure 16 below illustrates publishing.

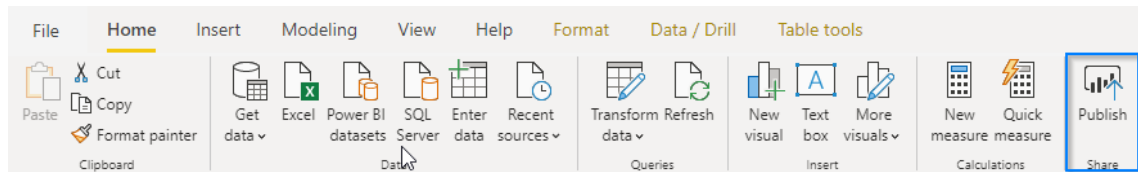


Figure 16. Publishing reports to Power BI service

As shown in Figure 16 above, it is describing the publishing of reports to the Power BI service and this was done on the home tab of the Power BI desktop.

5.2.6 Creating Dashboard

Once, reports were published to the Power BI service, the dashboard's building process was able to begin. In order to create the dashboard, needed visualizations had to be pinned from reports to the dashboard canvas. This was done by clicking on the visualization when 4 different icons appeared in the upper right corner. Figure 17 shows how this view looks like.

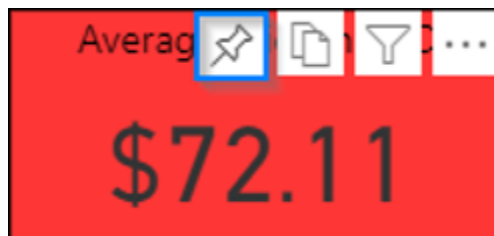


Figure 17. Pin mark in report page tile

After clicking the pin icon, the following pop-up window appeared. (See Figure 18 below).

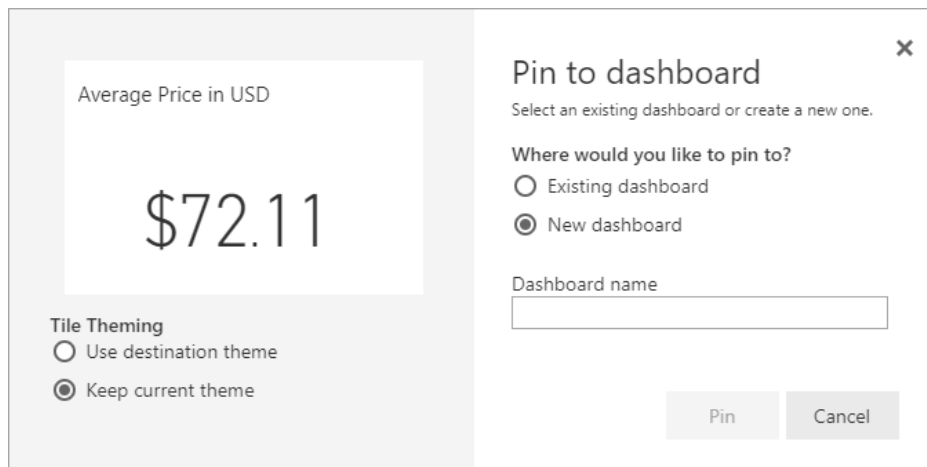


Figure 18. Pin for Dashboard

The pop-up window shows the visualization that will be pinned to the dashboard and two different options. These two different options were to create a new dashboard or use an existing one. It was also possible to change the tile's theme during this phase, but it was not necessary to do in this case. This same process was then performed for each visualization that needed to be included in the dashboard.

Once the dashboard was designed and ready, a second common meeting was held with the product managers via Microsoft Teams. The purpose of this meeting was to introduce the first version of the dashboard and all the other report pages that were fully completed. During this meeting it turned out that every product manager preferred more the report page layout design than the dashboard design because the report's pages included the exact same visualizations and information than the dashboard and the report pages also looked much more pleasant visually than the dashboard. The reason behind this is that the appearance of some visualizations, such as colors, cannot be utilized in Power BI dashboards. A good example of this is metrics made with card and KPI visualizations whose colors and original look cannot be used in the dashboard and in this work both of these visualizations were widely utilized. Also, the meaning of dashboard and report among the product managers was almost the same, since everybody saw the report page as a dashboard because in Power BI the difference between these two is not very big. Moreover, the report pages also contained more information that they liked more at this point. Therefore, any "real" Power BI dashboards were not created, so all report

pages previously created for the product managers ended up being so-called “dashboards” in this thesis. Figure 19 below is illustrating one of these “dashboards”.

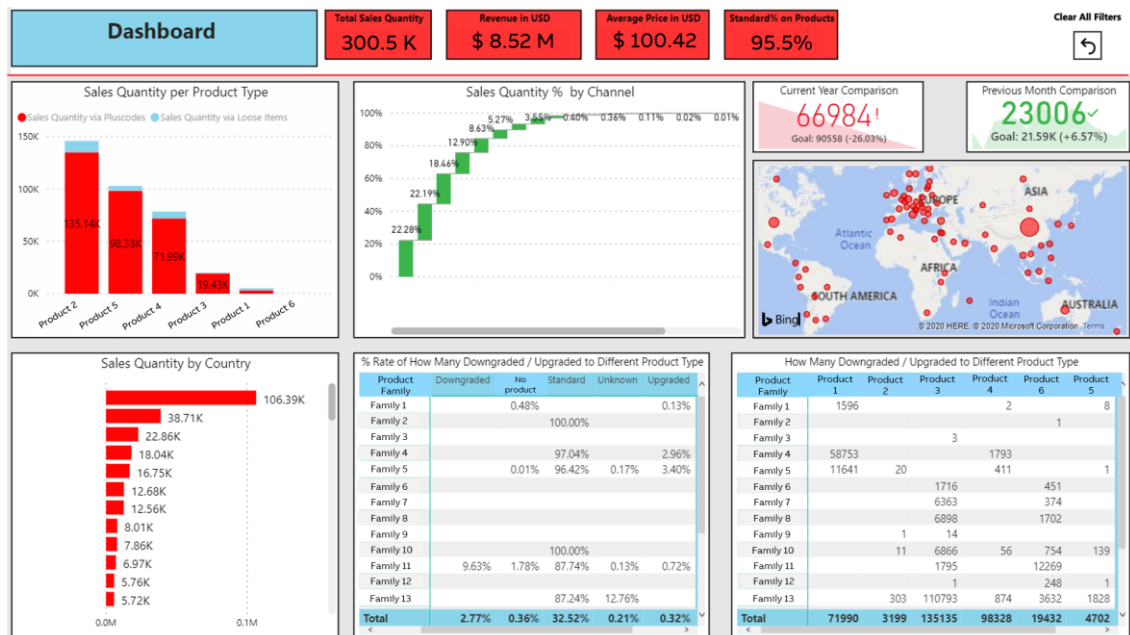


Figure 19. Accessories sales performance dashboard

Figure 19. illustrates one dashboard created for product managers. The following chapter (6.) describes in more detail the results and conclusions of the pilot versions of the dashboards from the product managers’ point of view.

6 Validation of the Initial Versions of the Dashboards

This chapter validates the initial versions of the dashboards developed and implemented in chapter 5. First, an overview of the validation stage is presented. Second, evaluation and feedback of the initial versions of the dashboards are presented in order to enhance the initial versions of the dashboards. Lastly, a summary of the results and future improvements is presented.

6.1 Overview of the Validation Stage

Validation of the initial versions of the dashboards was conducted to ensure that everyone's dashboards are displaying all the required measurements. It was conducted individually with product managers via Microsoft Teams. The objective of the validation was to verify that the final versions of the dashboards fulfill all the needs and requirements of the product managers and thus the objective of the thesis. Figure 20 below visualizes the steps of the validation stage.

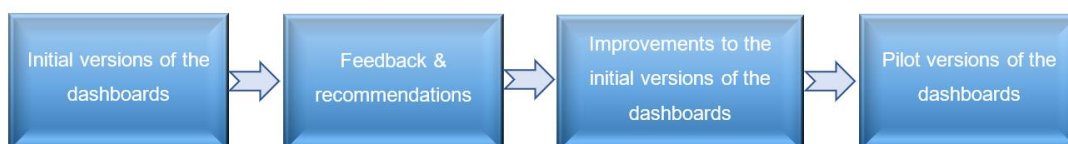


Figure 20. Overview of the steps of the validation stage

As shown in Figure 20, the validation was conducted in four steps. First, the initial versions of the dashboards were evaluated by the product managers. Second, feedback and recommendations were collected. Third, improvements based on feedback and recommendations were implemented in order to create the final versions of the dashboards.

6.2 Evaluation and Feedback of the Initial Versions of the Dashboards

Before interviews with the product managers, a link to the Power BI service and to the dashboards was sent so they could take a closer look at them. Like it was said earlier,

any "real" Power BI dashboards were not created in this thesis, but all the report pages created in this work ended up being so-called "dashboards". Therefore, all the validation is based on the report pages that were created during this thesis.

Generally speaking, every product manager was pleased with the outcome of the dashboards although everyone's report pages had some minor parts which needed some improvements. Those were mostly related to the designations and colors of the visualizations which were quite easy to change. Finally, when all the meetings with product managers had been held and all the minor changes made based on the recommendations and the feedback, the validation stage was ready.

6.3 Summary of the Results and Future Improvements

The validation feedback reveals that product managers were pleased with the dashboards. The dashboards of accessories sales performance support the case company's product management and especially the product managers in their daily activities now when all the dashboards are easily available at the same place and easy to use and up to date. Although the outcome of this project was a pilot version of accessories sales performance dashboards, they are already providing quite good measurements on accessories performance in the different markets. However, more needs to be done in the future before these dashboards provide deeper insights of accessories sales performance for the product managers. At the moment, dashboards created allow the product managers to easily monitor accessories sales performance in the different markets and thus increase their ability to make better decisions and improve operations. The outcome of this project also helps the case company's product management and product managers in processing and visualizing accessories sales data.

Future Improvements

During the interviews, it turned out that much of the feedback and many recommendations were not part of the objective and scope of the thesis. They were more related to future improvements. One of the requested improvements for the future was to build and add visualizations from the Microsoft Application Insights to the dashboard that is a feature of Microsoft Azure Monitor. It is used in the case company to monitor and understand users' acts in the apps that the case company provides for its customers. Additionally,

some of the product managers wanted to see also more detailed visualizations from the sales of their products in order to get deeper insights of the data. Therefore, all the requirements that were not part of the scope of this thesis, were documented for later evaluation and possible implementation. It is also worth mentioning that now when the initial metrics and visualizations are in place, defining the KPIs and targets for them more accurately and in more detail can be started so they would be aligned with the company strategy and objectives. When it comes to future improvements and next steps for them, all of them will be evaluated later with the product managers and then decided which ones will be implemented in the dashboards.

In the next chapter, the summary and conclusions of the study are presented.

7 Summary and Conclusions

This chapter presents the summary and conclusions of the thesis. This chapter consists of four parts that are an executive summary, next steps for the pilot versions of the dashboards, evaluation of the thesis and final words.

7.1 Executive Summary

The main objective of this thesis was to develop a pilot version of accessories sales performance dashboard for the case company's product management and especially for its product managers that would measure accessories sales performance in different markets. The thesis was carried out as part of a real-life business project run by the company's product management. This thesis aimed to visualize the accessories sales performance by showing the metrics and KPIs on the dashboard and thus provide insights from the data in order to support the product managers in decision-making.

This thesis was carried out in six stages. It started by familiarizing with the business challenge and defining objective, outcome and the scope for the thesis. Second, the current state analysis of the product managers' current way to measure, visualize and utilize data was carried out. As a result, strengths and challenges were identified.

After investigating the current state and identifying the initial requirements of the dashboards, topics for the literature were selected. It consisted of available knowledge and best practices that were explored based on the key findings of the CSA stage and the initial requirements of the dashboards. Therefore, the available knowledge and best practices regarding BI, Power BI, metrics, KPIs and dashboards were investigated. As a result, the conceptual framework (see table 5) was built to tackle the challenges revealed by the CSA by summarizing the knowledge and best practices that were investigated during this stage in order to build the initial versions of accessories sales performance dashboards. Next, the initial versions of the dashboards were built by merging the initial needs and requirements of metrics and KPIs and available knowledge and best practices. During this stage, two meetings with the product managers and one with the business analyst were held. Finally, the initial versions of the dashboards were validated by the product managers in order to verify that the final versions of the dashboards fulfill all the needs and requirements of the product managers and thus the objective of the thesis.

All in all, the dashboards created are expected to provide much value for product management and especially to the product managers by supporting them in their daily activities when all the dashboards are easy to use, up to date and easily available in the same place. Therefore, the pilot versions of accessories sales performance dashboards allow the product managers to easily monitor accessories sales data in the different markets and thus increase their ability to make better decisions and improve their daily operations. Additionally, any “real” Power BI dashboards were not created, so all report pages created for the product managers ended up being so-called “dashboards” in this thesis. Figure 19 on page 52 is illustrating one of these “dashboards”.

7.2 Next Steps of the Pilot Versions of the Dashboards

This thesis developed the needed dashboards for the product managers. However, more work needs to be done in the future before these dashboards can provide deeper insights of accessories sales performance for the product managers and to the whole product management. Therefore, next steps of the pilot versions of the dashboards were created. The next steps are presented in Table 7 below.

Table 7. Next steps for the dashboards pilot versions

	Step	Content
1	SQL Database	Validating the SQL database that is under development when it's ready.
2	More detailed KPIs	Defining more detailed KPIs and targets for them that are aligned with the company's strategies and objectives
3	Future improvements	Evaluating the feedback from product managers and recommendations about future improvements on dashboards together with the product managers.

First of all, the SQL database that is under development must be completely ready. When it is ready, the SQL database must be validated. After this, more detailed KPIs and targets for them need to be defined so that they are aligned with the company's strategies and objectives. After these steps, the dashboards start to provide deeper insights and real value for the product managers.

Moreover, the future improvement ideas that were collected during the last meetings from the product managers need to be taken into account and evaluated carefully before any decisions of their implementation can take place. Therefore, it was decided that the future improvements and next steps for them will be evaluated during the summer with the product managers. In other words, the development of the dashboards will continue during the summer.

7.3 Thesis Evaluation: Objective vs Results

The objective of this project was to develop a pilot version of accessories sales performance dashboard for the case company's product management and especially for its product managers that are responsible for accessories sales and performance. As a result of this project, each product manager got their own dashboards, which means that any shared dashboard was not created during this project. However, each project manager can still easily view the dashboards of others from the same place if they want.

Moreover, it is also worth mentioning that the objective of this thesis was changed during the project. The main reason for this can be stated to be the current way how the company is displaying accessories sales in the data that are sold via plus code. It complicates the data visualizing. It does not allow to create a shared dashboard for accessories sales performance. Therefore, many dashboards had to be created and most of the time went to the data preparing stage on this project.

In addition, it was originally intended to use SAP Business Warehouse to fetch and clean the data. However, the interviews revealed that the case company already has an ongoing project that aims to develop an automated real-time database to SQL server by collecting master data and products sales data from the company's various systems. It turned out that this database was already quite far developed which meant that it could be utilized in this study. Therefore, this study ended up developing pilot versions of accessories sales performance dashboards from this SQL database. All in all, when comparing the pilot versions of the dashboards created as a result to the objective, it can be stated that the results meet the product manager's expectations of this project.

7.4 Final Words

This thesis has been a huge and valuable learning experience for me since I am interested in working in the business intelligence and data analytics field in the future. This project gave me an invaluable opportunity to increase my knowledge and understanding of data analytics and develop my technical skills in Power BI. I was lucky to be able to conduct my thesis as a part of a real-life project for a multinational company. As final words, I would like to thank all the people who have helped me during this project and made it possible.

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