YRKESHÖGSKOLAN
NOVIA

Mapping the Needs for Dashboards in Product Management

Wärtsilä Engine Power Plants

Carl-Alfred Eklund

Degree Thesis for Bachelor of Engineering

Degree programme in Industrial Management and Engineering

Vaasa 2024

EXAMENSARBETE

Författare:	Carl-Alfred Eklund
Utbildning och ort:	Produktionsekonomi, Vasa
Handledare:	Christian Hultholm – Wärtsilä Energy
	Mikael Ehrs – Yrkeshögskolan Novia

Titel: Kartläggning av behoven för instrumentpaneler inom produkthantering

---

Datum: 23.5.2025 Sidantal: 57

Abstrakt

Detta examensarbete syftar till att kartlägga behoven och utveckla en skräddarsydd lösning för produktinstrumentpaneler för Wärtsilä Engine Power Plants produkthanteringsteam, som tillgodoser deras specifika behov och förbättrar arbetsflödeseffektiviteten. Forskningen inleds med en granskning av existerande litteratur för att fastställa bästa praxis inom design och innehåll för instrumentpaneler, vilket get en teoretisk grund för affektiv datavisualisering. Intervjuer med intressenter genomförs för att samla in insikter om teamets behov, önskade nyckeltal och utmaningar med nuvarande instrumentpaneler. Den primära datainsamlingen kompletteras med en jämförande analys.

Resultaten visar att mycket av den nödvändiga data existerar, men att den ofta är utspridd på olika plattformar, vilket försämrar tillgängligheten och ger upphov till tillförlitligheten. Intressenterna uttryckte och behov av avancerade funktioner som trendanalys och prognoser, vilket saknas i befintliga lösningar. Forskningen belyser vikten av tydlig och användarvänlig design, realtidsuppdateringar och interaktiva element.

Den minsta livskraftiga produkten som utvecklat genom detta examensarbete konsoliderar olika datakällor till en enhetlig plattform, med ett användarcentrerat gränssnitt som förbättrar datatillgänglighet och visualisering. Även om produkten för närvarande saknar datauppdateringar i realtid på grund av åtkomstbegränsningar, är den utformad som en grund för kontinuerlig förbättring, med hänsyn till intressenternas feedback och förändrande behov. Framtida förbättringar kommer att fokusera på att integrera realtidsuppdateringar, avancerade analysverktyg och ökade anpassningsalternativ.

Språk: Engelska

Nyckelord: Instrumentpanel, produkthantering, nyckeltal, minst livskraftig produkt.

BACHELOR'S THESIS

Author:	Carl-Alfred Eklund
Degree Programme:	Industrial Management and Engineering
Supervisor(s):	Christian Hultholm – Wärtsilä Energy
	Mikael Ehrs – Novia University of Applied Sciences

Title: Mapping the Needs for Dashboards in Product Management

---

Date 23.5.2024 Number of pages: 57

Abstract

This thesis aims to map out the needs and develop a customized product dashboard solution for Wärtsilä Engine Power Plants' product management team, addressing their specific needs and improving workflow efficiency. The research begins with a literature review to establish best practices in dashboard design and content, providing a theoretical foundation for effective data visualization. Stakeholder interviews are conducted to gather insights into the team's needs, preferred KPIs, and challenges with current dashboards. The primary data collection is supplemented by a comparative analysis.

The findings reveal that a lot of the necessary data exists, it is often scattered across various platforms, complicating accessibility and raising reliability concerns. Stakeholders also expressed a need for advanced features like trend analysis and forecasting, which are lacking in existing solutions. The research highlights the importance of clear, user-friendly design, real-time updates, and interactive elements.

The Minimum Viable Product (MVP) developed through this thesis consolidates various data sources into a unified platform, featuring a user-centric interface that enhances data accessibility and visualization. Although the MVP currently lacks real-time data updates due to access limitations, it is designed as a foundation for continuous improvement, incorporating stakeholder feedback and evolving needs. Future enhancements will focus on integrating real-time updates, advanced analytical tools, and increased customization options.

Language: English

Key words: Dashboards, product management, key performance indicators, minimum viable product

Table of Contents

List of Figures

1 Introduction

Product dashboards are tools that help companies manage their products more effectively. They simplify complex tasks, ensure resources are used wisely, and keep strategies aligned with what the market demands. By using dashboards, companies can easily see key performance indicators (KPIs) and metrics, giving them a clear view of how products are performing and what trends are emerging. This easy-to-understand data presentation improves decision-making and allows for quick responses to changes in the market.

This thesis focuses on the product management team at Wärtsilä Engine Power Plants (EPP). It delves into the complexities of their product portfolio and maps out the dashboard solutions to meet their specific needs. The aim is to map out and develop a solution that not only addresses the team's immediate requirements but also aids in long-term planning and boosts overall efficiency.

1.1 Background and Context of the Study

The product management team of Wärtsilä EPP is in charge of maintaining and updating their power plants. The team must have knowledge of the performance and projected long-term sales of different types of power plants to properly prioritize efforts. Furthermore, knowing the portfolio's composition, including the ratio of standard to customized plants, and the range of deliveries offers important background information for making strategic decisions. The product management team is relatively new, which is why they currently lack a dashboard solution tailored to their needs. This thesis aims to change that by building a foundation for a customized solution, which will be continuously improved to streamline their processes, provide more relevant and timely data, and enhance their ability to make informed decisions.

1.2 Problem Statement

Wärtsilä EPP lacks a tailored dashboard solution specifically catering to the needs of the product management team. Although widely available, current dashboards do not offer the targeted data necessary for efficient portfolio management. Even if the desired data can be found, it has to be exactly that – found. This hinders their workflow, making it harder to prioritize tasks, understand sales trends, and make informed decisions about their range of

products. The available dashboards, while plentiful, do not provide the focused data required for effective portfolio management. To bridge this gap, it is essential to develop a specialized product dashboard solution. A tool that will gather all the relevant data in one place, helping the team streamline their processes, make better decisions, and stay competitive.

1.3 Purpose of the Thesis

The purpose of the thesis is to map out the needs for dashboards within Wärtsilä EPP's product management team by conducting interviews with stakeholders and examining existing solutions. The secondary goal is to create a minimum viable product (MVP) based on insights gathered from the literature, interviews, and comparative analysis. The MVP's role is to act as a foundation for further improvement, helping the team find up-to-date data more efficiently.

1.4 Research Questions and Objectives

This section outlines the research questions and objectives that guide this thesis. The research aims to identify best practices and understand the specific needs of the product management team. The objectives include examining existing literature, conducting stakeholder interviews, and developing an MVP tailored to the team's requirements.

1.4.1 Research Questions

1. What are the best practices and key features associated with effective product portfolio dashboards, according to existing literature and industry standards?

2. What are the specific needs and requirements of Wärtsilä EPP's product management team in terms of data visualization, analytics, and decision support tools?

1.4.2 Objectives

1. Examine published works and studies from the industry to determine the best practices and essential components of a product dashboard.

2. To learn more about the specific requirements and needs of the product management team, by conducting interviews with key stakeholders, and providing recommendations from existing literature and industry standards.

3. Create a minimum viable product (MVP), a first version of a product portfolio dashboard for the product management team.

1.5 Significance of the study

The significance of this study lies in its potential to offer valuable insights and practical solutions to improve the way the product management team at Wärtsilä EPP makes decisions. The study intends to deliver tailored solutions that offer real-time insights and user-friendly data visualization capabilities, enabling the team to streamline operational procedures. It will do this by investigating the design and implementation of product portfolio dashboards.

1.6 Scope and limitations

The scope of this study is focused on exploring the design and implementation of product portfolio dashboards tailored to meet the specific needs of Wärtsilä EPP's product management team. It includes determining the key performance indicators, features, and functions needed for efficient decision-making and smooth operations inside the company.

It is important to recognize certain limitations within this scope. First off, the study's primary focus is to gather information which pertains to the product management team, which could restrict the applicability of findings to other teams and organizations. In addition, due to time and resource limitations, the study's goal is confined to creating a minimal viable product (MVP) for a customized dashboard solution, which will work as a foundation for future improvements.

1.7 Disposition

The thesis is structured as follows:

Chapter 1 – Introduction: Proved an overview of the study, including background, problem statement, purpose, research questions, objectives, significance, and scope.

Chapter 2 – Wärtsilä: Describes the company, its operations, and the role of the product management team.

Chapter 3 – Literature Review: Reviews relevant literature on dashboard design, key performance indicators, and data visualization techniques.

Chapter 4 – Methodology: Outlines the research design, including stakeholder interviews and comparative analysis of existing dashboards.

Chapter 5 – Design and Development of the Minimum Viable Product: Details the process of developing the MVP, incorporating insights from the literature review and stakeholder interviews.

Chapter 6 – Results: Presents the findings from the MVP development, including the features and functionalities of the final product.

Chapter 7 – Conclusion: Summarizes the study's contributions, answers the research questions, discusses challenges, and suggests future development.

2 Wärtsilä

Wärtsilä is a Finnish company specializing in advanced technology and lifecycle solutions for the maritime and energy markets. The company is headquartered in Helsinki, Finland, and operates globally with over 280 offices in 79 countries, employing approximately 17 800 people (Wärtsilä, 2024)

Wärtsilä operates through three primary business segments:

Wärtsilä Energy: This segment focuses on providing sustainable energy solutions, including power plants, hybrid solutions, and energy storage systems. They develop and supply technologies for various fuels, including hydrogen and synthetic methane, and aim to enhance grid stability and integrate renewable energy sources. In 2023, Wärtsilä Energy reported an annual revenue of 2,4 billion euros. Major customers include utility companies, independent power producers, and industrial clients worldwide. The segment has delivered over 79 GW of power plant capacity and more than 115 energy storage systems across 180 countries. (Wärtsilä, 2024)

Wärtsilä Marine: This segment provides a range of products such as engines, propulsion systems, electrification, and hybrid solutions, as well as integrated transmission systems. Wärtsilä Marine also offers lifecycle services, including maintenance and upgrades, to ensure the long-term operational efficiency of maritime vessels. In 2023, Wärtsilä Marine reported a revenue of 3,1 billion euros. Their major customers are shipbuilders, shipping companies, and naval forces globally. (Wärtsilä, 2024)

Wärtsilä Portfolio Business: This segment is composed of various business units that function independently of each other. Each unit is responsible for its own management and operations, allowing them to focus on specific opportunities and goals tailored to their individual needs. The combined turnover for this segment was 1,2 billion euros in 2023. Major units within this segment include Gas Solutions, Marine Electrical Systems and Water & waste. (Wärtsilä, 2024)

2.1 Wärtsilä Energy

Wärtsilä Energy focuses on decarbonization by developing solutions for the advancement of sustainable energy solutions. They help customers worldwide in reducing their carbon footprint by utilizing renewable energy sources.

Their strategy includes future-fuel-enabled power plants that adapt to various energy sources, enhancing grid stability. They also develop hybrid systems that combine traditional and renewable energy sources for power generation. Their energy storage and optimization technologies are used to further improve flexibility and efficiency.

They aim to offer services that increase productivity and reliability, ensuring optimal performance throughout the lifecycle of energy systems. They provide continuous support and maintenance to avoid downtime and operational risks.

Wärtsilä Energy is organized into three departments: Engine Power Plants, Energy Storage & optimization, and Lifecycle Services. Each department plays a role in advancing the company's mission to promote sustainable energy solutions and support the transition to a carbon-neutral future.

Engine Power Plants: This department produces power plants that can run on various fuels. These plants are designed for flexibility and efficiency. Their main customers are utility companies and industrial clients worldwide. (Wärtsilä, 2024)

Energy Storage & Optimization: ESO provides battery energy storage systems. These technologies help manage energy flows, store excess energy, and ensure reliable supply. Major customers are utility companies and renewable energy developers. (Wärtsilä, 2024)

Lifecycle Services: This department offers maintenance, upgrades, and real-time monitoring to ensure optimal performance of Wärtsilä's energy solutions. Their services help minimize downtime and extend equipment lifespan. They serve clients in both the marine and energy sectors. They have a global presence in over 160 locations. (Wärtsilä, 2024)

2.2 Wärtsilä EPP's Product Management

Product management is essential to any company's success, but it is especially important in sectors with rapidly evolving markets and high levels of technical innovation. Product management is key to Wärtsilä's strategy to generate innovation, customer value, and market leadership.

The goal of Wärtsilä Energy's product management team is to supervise the whole lifecycle of its wide range of solutions and products, from inception to obsolescence. Product managers and product owners at Wärtsilä Energy work closely with cross-functional teams, including research and development, engineering, and marketing, to identify market

opportunities, gather customer insights, and conceptualize new products and solutions. By leveraging their understanding of customer needs and market trends, product managers and product managers and product owners guide the development process. They also lead the product launch process, collaborating with marketing and sales teams to develop comprehensive go-to-market strategies

Product management is a critical driver of innovation, market success, and customer satisfaction. Strategic planning, cross-functional cooperation, and a client-centric mindset are how Wärtsilä Energy’s product management team makes sure that their solutions and products stay at the front of industry innovations and satisfy changing global customer expectations. (Friberg, 2024)

3 Literature Review

3.1 What is a Dashboard?

The way that a dashboard is defined is evolving. Dashboards are mostly visual information displays that are used for quick monitoring of current conditions that call for quick replies. This concept requires the given information to be easily understood at a glance, single-page view of constantly updated data. The conventional dashboard stereotype is challenged by the fact that the term “dashboard” is used to refer to a variety of items. Dashboard adoption has spread to new fields with the advent of ubiquitous data and visualization technologies, moving beyond single-view reporting displays to incorporate multipurpose interactive interfaces. Two major design perspectives are identified: the visual genre which is organized as a tiled arrangement of straightforward charts and large numbers, and the functional genre, which facilitates real-time monitoring of dynamically updated data. (Sarikaya, Correll, Bartram, Tory, & Fisher, 2019, p. 683)

3.2 Why do we Utilize Dashboards?

Understanding patterns and trends that might not be obvious from raw data alone requires the visualization of data. Even while two sets of numbers have comparable statistical characteristics, it can be difficult to identify differences or patterns just by looking at a table. However, the discrepancies are evident when shown in a chart, an illustration can demonstrate the ability of data visualization to highlight connections and patterns that could otherwise be missed.

Also, by presenting information in a more digestible way, data visualization improves memory retention. Comparing a line chart that presents the same data as a table. While the line chart offers instant insight into patterns across periods and product categories, the table necessitates looking at each figure separately.

Category	2013 Q1	2013 Q2	2013 Q3	2013 Q4	2014 Q1	2014 Q2	2014 Q3	2014 Q4
Furniture	$463,988	$352,779	$338,169	$317,735	$320,875	$287,934	$319,537	$324,319
Office Supplies	$232,558	$290,055	$265,083	$246,946	$219,514	$202,412	$198,268	$279,679
Technology	$563,866	$244,045	$432,299	$461,616	$285,527	$353,237	$338,360	$420,018
Category	**2015 Q1**	**2015 Q2**	**2015 Q3**	**2015 Q4**	**2016 Q1**	**2016 Q2**	**2016 Q3**	**2016 Q4**
Furniture	$307,028	$273,836	$290,886	$397,912	$337,299	$245,445	$286,972	$313,878
Office Supplies	$207,363	$183,631	$191,405	$217,950	$241,281	$286,548	$217,198	$272,870
Technology	$333,002	$291,116	$356,243	$386,445	$386,387	$397,201	$359,656	$375,229

Figure 1: A table containing the quarterly sales, organized into three categories. (Wexler, Shaffer, & Cotgreave, 2017, p. 5)

The table in Figure 1 contains the sum of sales for a company, organized into three categories. The data is very detailed, but crammed with large numbers, which makes it hard to get a picture of what is going on between the quarters and categories.

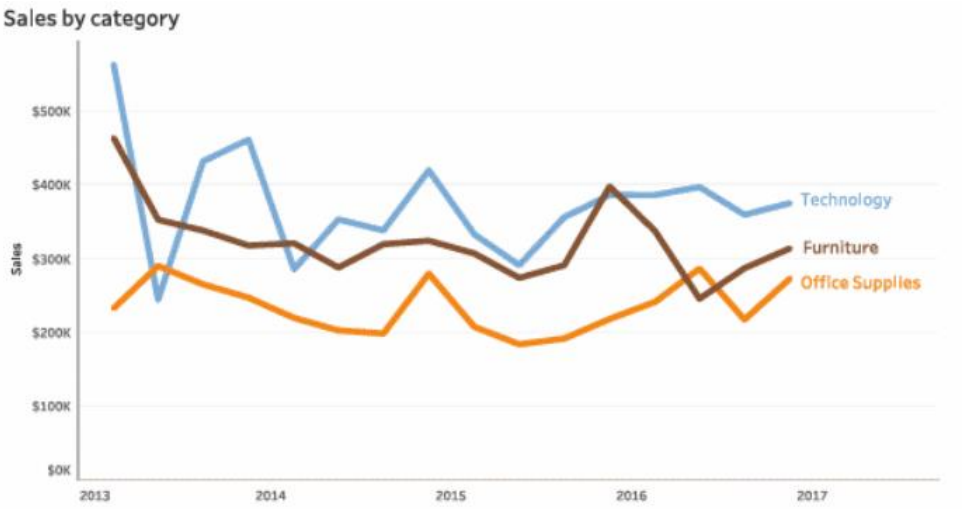


Figure 2: The data from Table 1 displayed in a line graph. (Wexler, Shaffer, & Cotgreave, 2017, p. 5)

Figure 2 depicts the same data found in Table 1, but now it is more digestible. Although it might lose some detail, you can now easily see differences, outliers and patterns in the data. This demonstrates how data visualization improves understanding and memory retention, enabling users to interpret vast amounts of data more effectively. (Wexler, Shaffer, & Cotgreave, 2017, pp. 3-5)

3.2.1 Key Performance Indicators for Product Management

Defining and measuring key performance indicators (KPIs) tailored to the unique aspects of product management can be quite challenging. Unlike production, which focuses on the

tangible flow of materials, product management involves a complex mix of strategic decision-making, market analysis, customer engagement, and ongoing product optimization. It is essential to identify and measure KPIs that truly reflect the effectiveness, efficiency, and customer value of product management efforts.

For companies like Wärtsilä Energy, it is crucial to design a comprehensive set of KPIs that align with their specific objectives and targets in product management. This means adhering to several key principles: ensuring relevance to the company's goals, maintaining high data quality, ensuring compatibility within the KPI hierarchy, adapting to changes, regular updates, effective data visualization, and considering the effort required to collect and analyze the data.

The first step is to clearly identify the targets of product management. These typically include driving product innovation, optimizing product performance, enhancing customer satisfaction, and maximizing business value. Developing a holistic set of KPIs involves analyzing existing indicators, identifying gaps, and selecting new indicators that comprehensively cover each target area. By balancing the measurement of effectiveness, efficiency, and customer value, companies can accurately gauge the success of their product management efforts. This approach enables informed decision-making, supports continuous improvement, and ultimately drives business growth and competitiveness. (Dombrowski, Schmidtchen, & Ebentreich, 2013, pp. 27-31)

3.3 How to Visualize Data

Data visualization is the process of turning data into visual representations by utilizing characteristics that our brains perceive quickly, such as color, size, and length. These pre-attentive qualities improve our capacity for effective data perception and interpretation. For instance, utilizing length in a bar chart enables quantitative comparisons and insights, while color differences can be used to quickly highlight particular data points.

Choosing the right visual depiction techniques for the type of data can be useful to create an effective visualization. Patterns and anomalies are revealed by spatial grouping and positional depiction. Position, size, and shape are examples of other pre-attentive properties that help with appropriate data representation.

Table 1: Examples of data types for visual depiction

Categorical	Ordinal	Quantitative
• Machinery (e.g., pumps, compressors,) • Tools (e.g., drills, saws, wrenches) • Materials (e.g., steel, aluminium, plastics) • Safety equipment (e.g., helmets, gloves, safety glasses)	• Equipment sizes (e.g., small, medium, large) • Durability levels (e.g., light-duty, medium-duty, heavy-duty) • Complexity levels (e.g., basic, intermediate, advanced) • Regulatory compliance (e.g., compliant, partially compliant, non-compliant)	• Price (e.g., 1000€, 5000€, 10000€) • Weight (e.g., 50 kg, 100 kg, 200 kg) • Power ratings (e.g., 10 kW, 50 kW, 100 kW) • Production output (e.g., 100 units/hour, 500 units/hour, 1000 units/hour)

Visualizations that promote comprehension and insight can be made by selecting suitable visual depictions for categorical, ordinal, and quantitative data types and by comprehending the utility of pre-attentive qualities. As seen in **Table 1,** categorical data is labels that lack a numerical value. Ordinal data is similar to categorical but has a distinct order. Quantitative data is made up of numerical values that can be measured and analyzed. This knowledge can be useful when choosing visualization. (Wexler, Shaffer, & Cotgreave, 2017, pp. 5-11)

Visualizing data involves designing and creating easily communicated and digestible graphical or visual representation of complex data. By utilizing pre-attentive characteristics, like color, size and length, which our brains quickly analyze before conscious attention, we improve our capacity to effectively perceive and understand info.

Figure 2: Two clusters of numbers showing the usage of pre-attentive attributes (Wexler, Shaffer, & Cotgreave, 2017, p. 6)

Take Figure 3 as an example, variations in hue can immediately draw attention to particular data points. Similar to this, quantifiable comparisons and insights can be obtained by depicting the frequency of each number in a bar chart using length.

Hue works well when highlighting one or a few categories but trying to highlight more categories than a few can quickly turn into a mess. Changing the hue of a majority or every category can make it even harder to distinguish the categories from each other, than without any color at all, as seen in

If the goal is to highlight the quantity of categories, a bar chart might be a better solution, since it is easier on the eyes, with less clutter, and more concise information.

Figure 3: Highlighting too many categories.

Understanding how to use color in data visualization is important but often misunderstood. It is not just about making things look pretty; sometimes, less color is better, as showcased in Figure 4. Color should have a purpose, like guiding attention, emphasizing data, or categorizing information. There are three main ways to use color in data visualization: sequential, diverging, and categorical. And sometimes, you just need to use color to highlight important data or alert the user of the dashboard about something.

Sequential color involves using a single color from light to dark to represent progression. For instance, you might use shades of red to depict increasing temperatures from cooler to warmer areas.

Diverging color is used to display a range diverging from a midpoint. Similar to the sequential scheme, it can represent two different ranges of a measure, such as positive and negative values, or a range between two categories. Let us use the temperature example again, weather maps often use diverging color, with blue indicating cooler temperatures and red indicating hotter temperatures, with the midpoint representing neutrality, an average or target.

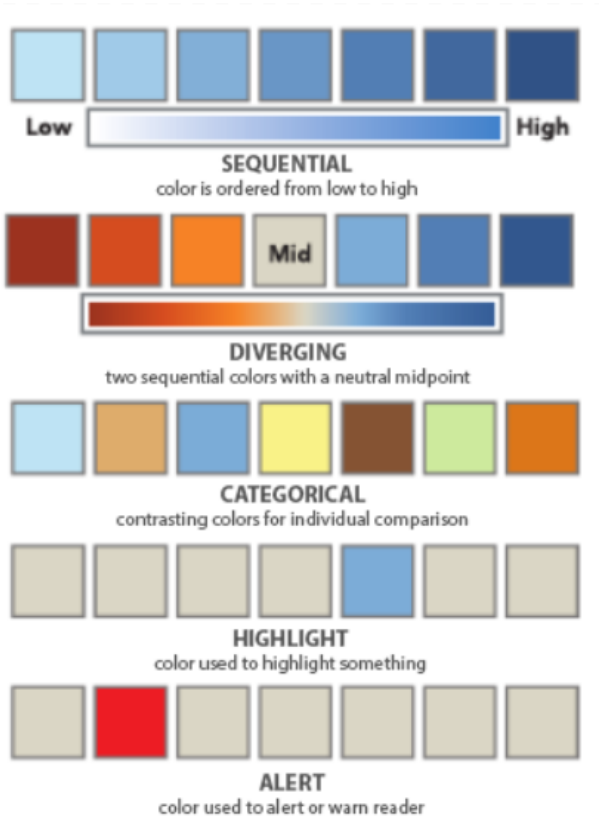


Figure 4: Use of color in data visualization (Wexler, Shaffer, & Cotgreave, 2017, p. 15)

Categorical color utilizes different hues to differentiate between categories. For example, you might use different colors like red for apples, yellow for bananas, orange for oranges, and green for grapes to visually separate each category of fruit.

Highlight color is employed when something needs to be emphasized without alarming the reader. It can be used to highlight specific data points, text in a table, lines on a chart, or bars in a bar chart.

Alerting color is used when there is a need to urgently draw attention to something. Bright, attention-grabbing colors are typically used in such cases to quickly alert the reader to important information.

It is also possible to have a categorical-sequential color scheme. In this case, each category has a distinct hue that is darker or lighter depending on the measurement it is representing. (Wexler, Shaffer, & Cotgreave, 2017, pp. 11-18)

3.4 Dashboard Design Principles

Geometry and aesthetics play a critical role in enhancing or impeding the clarity of visual data representation. The selection of specific geometries and formatting choices profoundly influences how information is perceived and understood.

The choice of geometry, whether it involves simple bar graphs or complex scatter plots, dictates how data is contextualized. Geometries not only represent data but also guide the viewer's interpretation, making the selection process pivotal. Effective visualization requires more than just presenting the data, it involves choosing geometries that best represent the underlying patterns and relationships within the data while maintaining a high data-ink ratio to maximize informational clarity. (Midway, 2020)

The data-ink ratio is a concept that measures the proportion of graphic's ink devoted to the actual data compared to the total ink used in the entire graphic. A high data-ink ratio means most of the graphic represents data, enhancing clarity and focus. (Tufte, 1983, pp. 93-96)

Formatting in data visualization involves more than aesthetic appeal, it includes the strategic use of color, line types, and text to make visuals not only appealing but also functionally effective.

The narrative suggests that while there are numerous established guidelines for creating effective visualizations, there is often room for personal creativity and preference. This flexibility allows the designer to adapt visual strategies to specific data sets and audience needs, illustrating that effective data visualization is both an art and a science. (Midway, 2020)

3.4.1 Dashboard Structuring

The first step in dashboard structuring is to gain a deep understanding of user needs and requirements. This involves conducting thorough needs assessment activities, such as user interviews, surveys, and stakeholder consultations. By engaging the end-users and key stakeholders, the developer can identify the specific metrics, KPIs, data sources, and functionalities that are essential for addressing business challenges and achieving organizational objectives.

Once the user needs have been identified, the next step is to structure the MVP of the dashboard solution. The MVP serves as an initial version of the product that contains the

core features and functionalities necessary to address the most critical user needs while minimizing development time and resources. By incorporating user feedback loops into the development process, developers can iteratively refine the dashboard structure and functionality to better align with user needs and preferences. (Vásques-Ingelmo, García-Peñalvo, & Therón, 2019)

3.5 Minimum Viable Product

The concept of the Minimum Viable Product (MVP) is more relevant than ever, particularly in technology sectors. Originating from Lean Startup methodology, MVP is about learning as much as possible about customer needs and market fit, with the least number of resources used. This approach is invaluable to teams like those at Wärtsilä Energy, as well as this thesis, where efficiently aligning product development with user requirements is critical.

An MVP is essentially the bare bones version of a product, designed to perform the necessary functions with no extra frills. It includes just enough features to be usable and provide meaningful feedback. For a product management dashboard, this means incorporating key functionalities that directly impact decision-making and operational efficiency, such as real-time data visualization and critical metrics tracking.

Developing an MVP for a product management dashboard involves identifying these essential features that meet the core operational needs. The development process should be agile, focusing on rapid prototyping and frequent iterations. This iterative approach allows the team to integrate real user feedback into subsequent versions of the product swiftly, ensuring that the dashboard evolves in a direction that continues to meet the needs of its users.

The initial build of the dashboard should focus on simplicity and quick deployment. It should deliver identified key features effectively while maintaining an intuitive user interface. Once deployed, its effectiveness can be gauged by how well it facilitates management tasks and decision-making processes. Feedback from these early sessions is crucial, as it directs the future course of development, highlighting which additional features are necessary and which assumptions about user needs were incorrect.

Each cycle of feedback and enhancement brings the product closer to what is truly needed, often leading away from initial assumptions to more innovative and finely tuned solutions. This process not only enhances the functionality of the dashboard but also ensures that it

remains adaptable and relevant to the changing dynamics of product management environments. (Lenarduzzi & Taibi, 2016, pp. 112-119)

3.5.1 Navigating Challenges in Dashboard Implementation

When using dashboards, there are a number of challenges to overcome, such as unrealistic expectations, miscommunications, and technology constraints. Developers often encounter these challenges when trying to balance dashboard usefulness and efficacy with user preferences and needs.

In order to pinpoint issues and enhance dashboard usability, developers frequently rely on user feedback. The research, however, indicates that users might not always adequately convey their problems to engineers. The efficacy of dashboard systems may be hampered by developers failing to recognize issues due to this lack of communication.

One of the most prevalent issues is the discrepancy between the complexity of dashboard displays and the users' visual literacy. Complex visuals may be difficult for the users to grasp, which can cause problems with data comprehension and spoil their confidence in dashboard insights.

When merging data from several sources into dashboards, developers must deal with problems related to data quality and interoperability. Dashboard insights' accuracy and dependability may be compromised by poor data quality and a lack of interoperability.

When it comes to the functionality and customization of dashboards, users frequently have a variety of demands and preferences. It could be difficult for developers to balance these many demands while preserving the usefulness and efficacy of the dashboard.

Dashboarding tools put technical restrictions and limitations on developers, which may limit their capacity to implement particular features or functions. Dashboard usability and general design may be impacted by these limitations.

To solve user issues and enhance dashboard usability, developers use a variety of adaptation strategies. These methods include automatic adjustments depending on user behavior and preferences as well as customization and personalization. With customizable adaptations, users may customize their dashboard experience to suit their needs and tastes. Developers must strike a balance between the risk of overstuffing customers with options and customizing possibilities.

Based on the responsibilities, objectives, and skills of the user, personalized adaptations offer material and dashboard elements that are specifically suited to them. Automatic adaptations allow dashboard items to be changed in real time according to data formats and user behavior.

Although flexible dashboards have many advantages, developers may run into issues with technical implementation and user resistance. To properly discover and prioritize adaptable features, developers and users must work together to overcome these obstacles. (Alhamadi, Alghamdi, Clinch, & Vigo, 2022, pp. 11-15)

4 Methodology

This chapter outlines the research design for the thesis. The research design encompasses various methodologies aimed at achieving the study's objectives, which include analyzing literature on dashboard design and content, conducting stakeholder interviews to identify KPIs and metrics, and comparing existing solutions to inform the development of an MVP tailored to the production management team's needs.

Literature Review

The research began with a thorough review of existing literature on dashboard design and content. The literature review is used as it helps to build a strong theoretical foundation for understanding what makes an effective dashboard. By diving into the existing body of knowledge, we can gather insights into the principles of good dashboard design and identify the essential components that make dashboards informative and useful.

The knowledge gained from the literature review helps ensure that the dashboards we develop are grounded in proven strategies, increasing their effectiveness and usability. The literature review also helps identify gaps in current dashboard solutions, guiding the development of a product that truly meets the needs of Wärtsilä Energy's product management team. Additionally, the insights from the literature review were used to inform the next step: conducting stakeholder interviews.

Stakeholder Interviews

Following the literature review, qualitative interviews were conducted with key stakeholders from the product management team. This method was chosen because it provides firsthand insights and practical knowledge that cannot be obtained from literature alone.

Talking directly with the stakeholders helps us understand which KPIs and metrics are most relevant and useful for their processes. By asking questions and encouraging discussion, we gain an understanding of their perspectives on the current dashboards' limitations. This includes identifying what content, formats, and functionalities they find lacking or inconvenient.

The interviews are designed to be conversational, allowing stakeholders to freely express their thoughts and needs. This approach helps uncover details about their daily workflows, challenges, and preferences that might not emerge in a more structured survey.

The main reason for using stakeholder interviews in the thesis is to ensure that the new dashboard solution is tailored to the team's real-world requirements. By incorporating their feedback, we aim to develop a tool that addresses their specific pain points and enhances their ability to make decisions.

Comparative Analysis

In addition to gathering information directly from stakeholder interviews, the research design also includes a comparative analysis. This involves taking a close look at the dashboards currently used within Wärtsilä Energy and comparing them with those used in similar industries. The purpose of this comparative analysis is to thoroughly examine the layout, design, and features of these dashboards.

By examining the layout of existing examples, we aim to understand how information is organized and presented. This can be used to ensure that the dashboards are user-friendly, and that critical information is easily accessible to users. Understanding the layout helps determine the effectiveness of dissemination and user interaction with the dashboard.

Analyzing the design features allows us to assess aesthetic and functional elements such as color schemes, typography, and visual hierarchy. Effective design can significantly enhance usability and user satisfaction. By evaluating these design aspects, we can ensure that the dashboards are not only visually appealing but also functional.

Comparing Wärtsilä EPP's dashboards with those used in similar industries provides a benchmark for best practices. This comparison highlights areas where Wärtsilä Energy's dashboards do well and areas where there may be opportunities for improvement. By understanding best practices in the industry, we can adopt and adapt these strategies to enhance our own dashboards.

Identifying the strengths of current dashboard practices helps to reinforce successful elements in future designs. Pinpointing the weaknesses of current dashboard practices allow for targeted improvements. Understanding what works well and what does not ensure that the features implemented in the MVP follow the best practices.

4.1 Stakeholder Interviews

This chapter presents the findings derived from qualitative interviews conducted with key stakeholders within the Product Management Team. While it is possible to develop an MVP

based on theory and existing examples, this approach typically results in more iterations of the MVP, as adjustments are necessary once user feedback is inevitably incorporated. Other forms of data collection could alternatively gather this information but given the unique and perhaps not well-understood external perspectives on the team's needs, a more open-ended, interview-style discussion was preferred. This method allows interviewees to freely describe their individual needs, ensuring that the MVP can be tailored more precisely from the outset, thereby reducing the need for extensive revisions.

We decided to use qualitative interviews as our primary data collection method to gain insights into how stakeholders work with dashboards and what they need from these tools. Unlike surveys or questionnaires, interviews allow for open-ended questions and follow-up queries, enabling us to explore specific areas in greater depth. This approach is particularly beneficial for understanding nuanced needs and preferences that might not be captured through more structured forms of data collection. We interviewed ten stakeholders to gather these insights.

The selection of interviewees was a collaborative process involving the supervisors at Wärtsilä and input from other key stakeholders. We aimed to choose individuals who have a significant role in using and interacting with dashboards within the product management team. This included Product Managers, Product, Owners, Product Architects, Technical Sales Support, and Directors of Product Management and Technology. These roles were chosen to provide a comprehensive view of the team's needs, as they cover strategic, technical, and operational perspectives.

The interviews were conducted either online via Microsoft Team or face-to-face in the office, providing flexibility and accommodating the availability of the participants. The participants were contacted by email or Teams with the help of contact information provided by Wärtsilä.

We selected these specific individuals because their roles involve frequent and varied use of dashboards, making them well-suited to provide detailed feedback. Other roles were not included as their interaction with dashboards is less central to their responsibilities. In hindsight, even fewer interviews might have sufficed since the responses began to show repetitive patterns, indicating that the main issues and needs were consistently identified early on.

4.1.1 Interview Topics and Insights

The expectation of the interviews was to reveal details about the frequency of dashboard usage, the specific dashboards most commonly used, and the key metrics and features considered essential by the stakeholders. By the stakeholders. We anticipated hearing about desired features such as trend analysis, benchmarking, and real-time updates, as well as pain points like exporting of data and usability issues. The way we framed our questions – broad and open-ended – was intended to avoid leading the interviewees and to encourage them to share their honest and comprehensive thoughts. However, this approach could also mean that the way questions were asked might slightly color their answers, as some interviewees might align their responses to what they perceive as expected or relevant to the research focus.

Topics discussed:

Frequency of Dashboard Usage: This topic aimed to understand how often stakeholders within the team utilize dashboards in their tasks. By gauging the frequency of dashboard usage, assessment of the level of reliance on these tools for decision-making and information access.

Mainly Used Dashboards: The goal here is to identify dashboards that stakeholders rely on most frequently. Understanding which dashboards are predominantly used provides insights into the types of information and metrics that are deemed essential for various roles within the team.

Most important KPIs and Metrics: This topic seeks to uncover the KPIs and metrics that stakeholders prioritize when assessing product performance. Identifying these metrics is vital when designing dashboards that focus on delivering actionable insights.

Feature Needs: The objective is to elicit stakeholders' preferences regarding additional features or functionalities they would like to see in dashboard solutions. This includes features such as trends analysis, benchmarking against competitors, real-time data updates, and customizable views tailored to individual needs.

Typical Pain Points with Dashboards: This topic aims to identify the challenges and limitations associated with existing dashboard solutions. Understanding pain points helps in addressing usability issues, data integration challenges, and other obstacles that hinder the effectiveness of dashboards.

Detail Level Needed of the Dashboards: Ascertaining stakeholders' preferences regarding the level of detail required in dashboard presentations. This includes determining whether stakeholders prefer granular data for in-depth analysis or summarized insights for quick decision-making.

Hypothetical One-Stop Dashboard: This topic was used to encourage stakeholders to envision their ideal dashboard solution, a comprehensive platform that integrates all necessary data and functionalities into a single interface.

Other Wishes or Comments Pertaining to Product Management Dashboards: This open-ended question allows stakeholders to provide any additional feedback, suggestions, or comments regarding product management dashboards. It provides an opportunity for stakeholders to express unmet needs or desires that may not have been addressed in previous topics.

4.1.2 Interview Findings

Through the interviews with stakeholders within Wärtsilä EPP's Product Management Team, we learned a lot about their current usage of dashboards, what KPIs, metrics and features they find most useful, and the challenges they face.

The data collected from the interviews was generally very insightful, although the quality and depth of the responses varied. The first interview conducted was notably comprehensive, which somewhat overshadowed the subsequent ones as it provided a wealth of detailed information early on.

There was inherent bias in the answers, which is expected in qualitative research. Each interviewee provided feedback based on their specific experiences and roles, resulting in a range of perspectives. The objective was to synthesize these biased views into a holistic solution that addresses the common needs and pain points identified. Some interviewees provided more actionable insights than others, but overall, the data collected was sufficient to form a clear picture of the current challenges and requirements for the solution.

Findings from the interviews:

The frequency of dashboard usage varies significantly among stakeholders. For some, dashboards are integral to their daily tasks, providing data for day-to-day operations. For others, especially those involved in strategic roles, dashboard usage is more sporadic, often

tied to quarterly reviews and reporting periods. While main tasks might require less frequent interactions, smaller tasks and on-demand reports require more regular, sometimes daily, use of dashboards.

Stakeholders primarily mentioned three main dashboards: Sales Pipeline, EPP Technology, and Project Execution. These dashboards are central to the team's workflow, providing information for managing projects and tracking performance. However, there are also several other dashboards that cater to specific needs, such as Risk Management, Safety, Project Overview, Project Schedule, and Status Reports. These are used within the team for more specialized tasks, indicating a diverse range of dashboard requirements across different roles.

When asked about the most important graphs and data, stakeholders provided a wide array of responses. This question generated a lot of varied answers, reflecting the diverse nature of their strategic, technical, and operational needs. The extensive variety of responses made it challenging to interpret these answers, particularly without direct access to most of the existing dashboards.

The discussion about desired features produced more straightforward findings. Stakeholders consistently mentioned the need for trend analysis, forecasting capabilities, comparison to past periods, and various drill-down options. These features are used to enhance the usability and effectiveness of the dashboards, allowing for deeper insights.

Several pain points were identified during the interviews, highlighting areas where the current dashboards fall short. A common issue is that similar data points are often split across different locations, making it difficult to compile and analyze the information efficiently. The dashboards' tables are usually too wide, packed with information that they do not fit into a single page view, complicating their readability and usability.

Another significant problem mentioned is the inability to export data from the dashboards in an efficient manner. While this restriction is in place for safety and continuity reasons – to prevent tampering and ensure data quality – it hinders users' ability to perform further analysis. Additionally, some stakeholders mentioned the presence of faulty data, such as incorrect ambient temperature readings, which could undermine their confidence in the dashboard data.

Also, finding the desired data can be challenging if it is not used regularly, due to the scattered setup of the dashboards. This indicates a need for better organization of the dashboards used by the team.

The question about the level of detail required did not generate much feedback. It was later found that most dashboards are set to display data at a specific level, but they can be filtered to meet the user's needs. This flexibility is very useful, although it might not be fully utilized due to a lack of awareness.

When asked about a personalized one-stop dashboard, stakeholders provided varied responses, similar to the feedback on important data. They expressed a need for a dashboard that integrates multiple important data points and functionalities, allowing for a comprehensive view while still retaining access to less frequently used data. This indicates that while there are core metrics and features used regularly, the ability to access a broader range of data remains important.

Proposed solution:

To address these challenges, the development of a centralized navigation portal tailored specifically for the product management team was proposed. This portal would serve as a one-stop destination, gathering data and graphs from existing dashboards and providing easy access to the information needed for informed decision-making. Additionally, dashboards containing new data, found in the interviews, would be developed and included in the portal, ensuring that it offers a comprehensive view of relevant metrics. By consolidating both existing and new data sources, the navigation portal aims to streamline the process of finding relevant dashboards and accessing reliable data, thereby enhancing the effectiveness of the product management team.

4.2 Comparative Analysis of Existing Navigation Portals

To design an effective navigation portal for the product management team, it is useful to examine existing portals and analyze their strengths and weaknesses. Using comparative analysis in creating a dashboard solution helps identify effective features and avoid common pitfalls by examining existing dashboards in similar applications. This approach ensures the final product meets specific needs efficiently. By learning from the successes and shortcomings of others, developers can create a dashboard solution that not only functions well but also integrates seamlessly with their operational and strategic requirements.

Here, we consider three examples: the “Area Portfolio Report”, the “Technology & Product Management” and the “Quality” navigation portals. We will evaluate their design, organization, user accessibility, and information presentation.

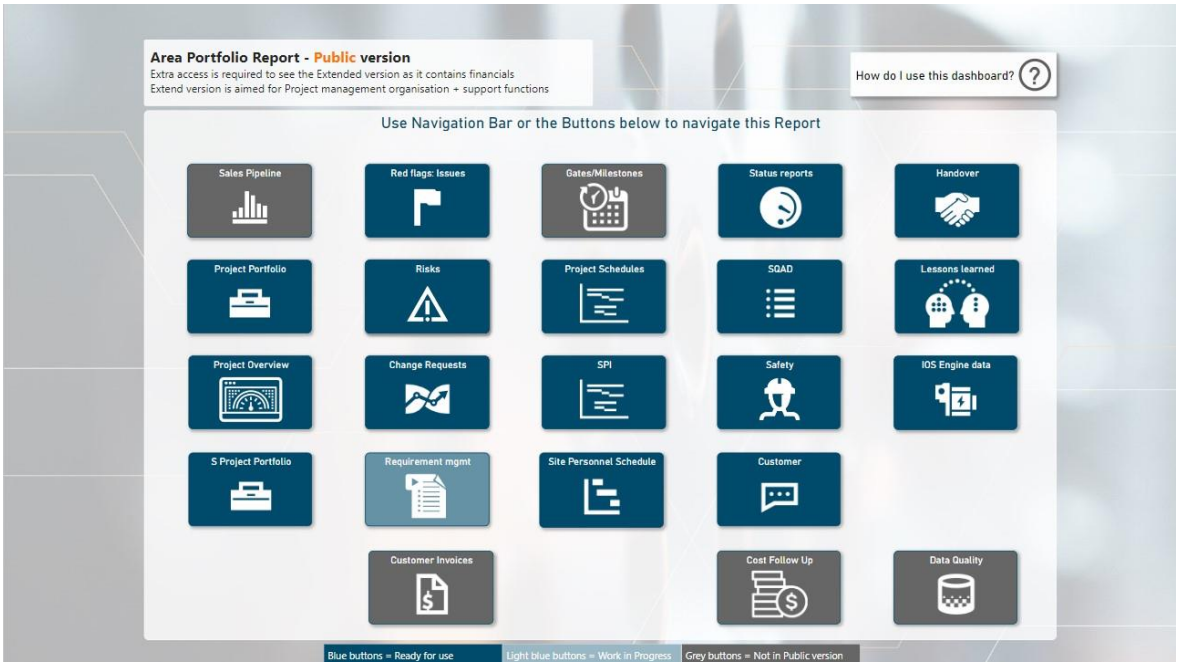


Figure 5: "Area Portfolio Report" Navigation Portal

Visual Design and Layout: The design is grid-based with uniform iconography, which contributes to a clean and organized appearance. The use of blue and grey hues is consistent, differentiating between available, in-progress, and restricted sections. The top banner is clear and informative, succinctly explaining the purpose and access limitations.

Organization and Accessibility: This portal is well-organized, with clearly defined categories and a logical flow. However, the portal lacks interactive elements such as tooltips that could enhance user experience by providing quick information on hover without leaving the page.

Information Presentation: It proved a high-level overview suitable for quick access and decision-making but lack direct accessibility features such as searchable content or customizable views. Might not be necessary with this amount of content, but something to keep in mind.

User Guidance and Help: The inclusion of a “How do I use this dashboard?” helps new users understand the layout and functionality, which is a positive feature.

Figure 6: "Technology & Product Management" Navigation Portal´

Visual Design and Layout: This portal also uses a grid layout but incorporates different shapes and slightly more varied colors. The design feels slightly busier due to the mixed use of icons and text boxes. The “Work in Progress watermark is a helpful notification, though it might be visually distracting.

Organization and Accessibility: Offers a broader range of categories and sub-categories but can seem overwhelming due to the dense packing of options.

Information Presentation: This portal seems to cater more to users needing detailed and specific information, including direct links to reports and tools. However, it could benefit from filtering options or a search function to handle the volume of information better.

User Guidance and Help: Lacks visible user guidance which might make navigation challenging for first-time users.

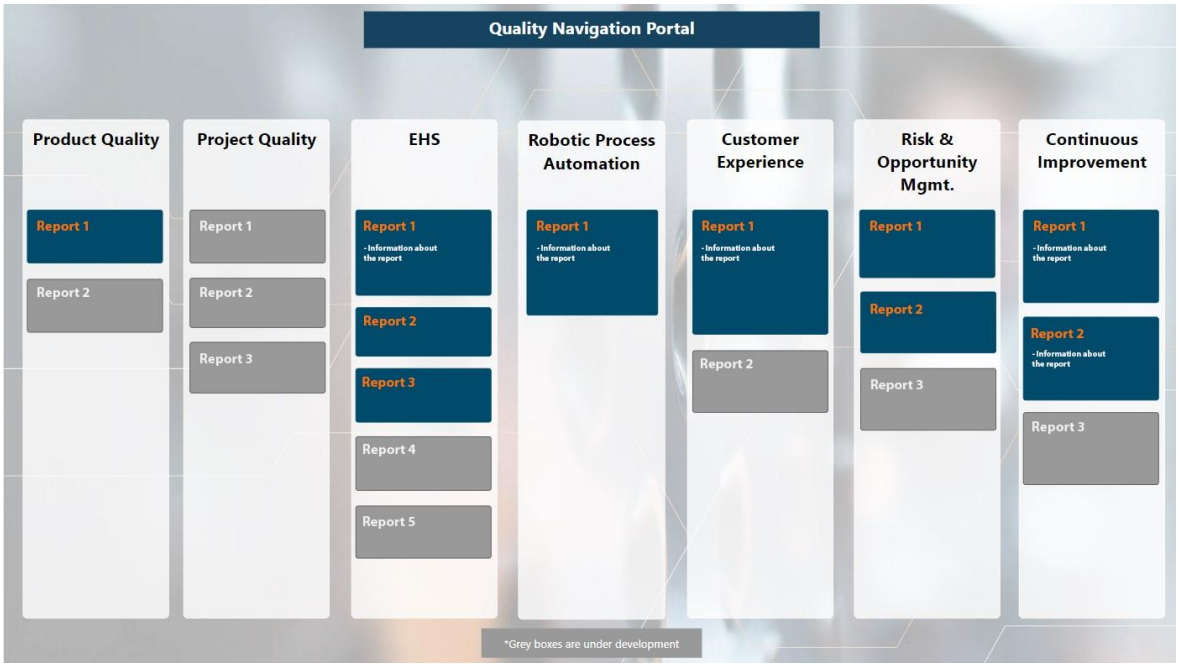


Figure 7: Quality Navigation Portal

Visual Design and Layout: Features a column-based layout with clearly differentiated sections for each quality aspect. The use of contrasting colors for available reports and under-development reports is straightforward and effective. The design is minimalist, focusing solely on functionality without additional decorative elements.

Organization and Accessibility: It is organized into categories with reports directly accessible from the main page, which is practical for users who know that they are looking for.

Information Presentation: Each report is listed clearly, and reports under development are visibly marked, which helps set expectations about what information is immediately available versus what will be soon. However, there might be a missed opportunity to provide brief descriptions or tooltips for each report, enhancing the user's understanding without needing to open the report.

User Guidance and Help: This portal, similar to the "Technology & Product Management, lacks explicit guidance or help options for new users. Incorporating an introductory guide or tooltips can greatly enhance user understanding and efficiency.

4.2.1 Recommendations for a New Portal

In Designing a new navigation portal for the product management team, it is crucial to integrate the best features from existing models, while also addressing their shortcomings.

Visual Design and Layout: A Clean, minimalist design, such as that seen in the Quality Navigation Portal, can be very effective. Use a consistent, intuitive layout with clear visual distinctions between different sections and types of information. For example, contrasting colors can be used to indicate available reports versus those still under development. Additionally, incorporating a grid-based design with uniform iconography can help maintain an organized and visually appealing interface.

Organization and Accessibility: Direct access to content, as demonstrated in the Quality Navigation Portal, is valuable for efficiency, allowing users to Quickly find and engage with the reports they need. Still, to accommodate more complex needs and improve usability, advanced navigation tools such as filters could be incorporated. These features can help users navigate through large volumes of information more effectively if needed.

Information Presentation: Each category or report should be clearly labelled and, where possible, accompanied by brief descriptions or tooltips. This will help provide users with immediate context or a summary of what the report entails, aiding them in finding the desired data.

User Guidance and Help: To enhance user experience, particularly for new users or complex portals, include an introductory guide or tooltips. These should offer clear instructions on how to use the portal effectively. Consider readily available help sections that users can refer to as needed.

4.3 Comparative Analysis of Existing Dashboards

This chapter presents a comparative analysis of existing dashboards. The goal of the analysis is to extract valuable insights that can be applied to the development of a new product management dashboard. By understanding how various dashboards cater to their respective domains, helps us better tailor a solution that meets the needs and challenges of the end-user. The functionality provided by each dashboard will be analyzed, considering the tools and features that facilitate effective data management. The analysis also covers the user experience, looking at how each dashboard supports ease of use, customization options, and interactivity.

The dashboards used in the analysis are internal Wärtsilä dashboards, dashboard templates, and a dashboard by Roll-Royce, which is specifically designed for maritime operations. The internal Wärtsilä dashboards are analyzed to understand current practices and to ensure that

the new dashboard integrates seamlessly with existing systems and is readily adopted by the team. The dashboard templates offer insights into alternative features and layout that could enhance Wärtsilä's dashboard solutions, providing a spectrum of design and functionality ideas, when real-life examples of operational dashboards are often difficult to access due to proprietary restrictions or confidentiality concerns. The Rolls-Royce dashboard was chosen for its real-life application in a similar industry, this dashboard provides a concrete example of handling high real-time data refresh rates.

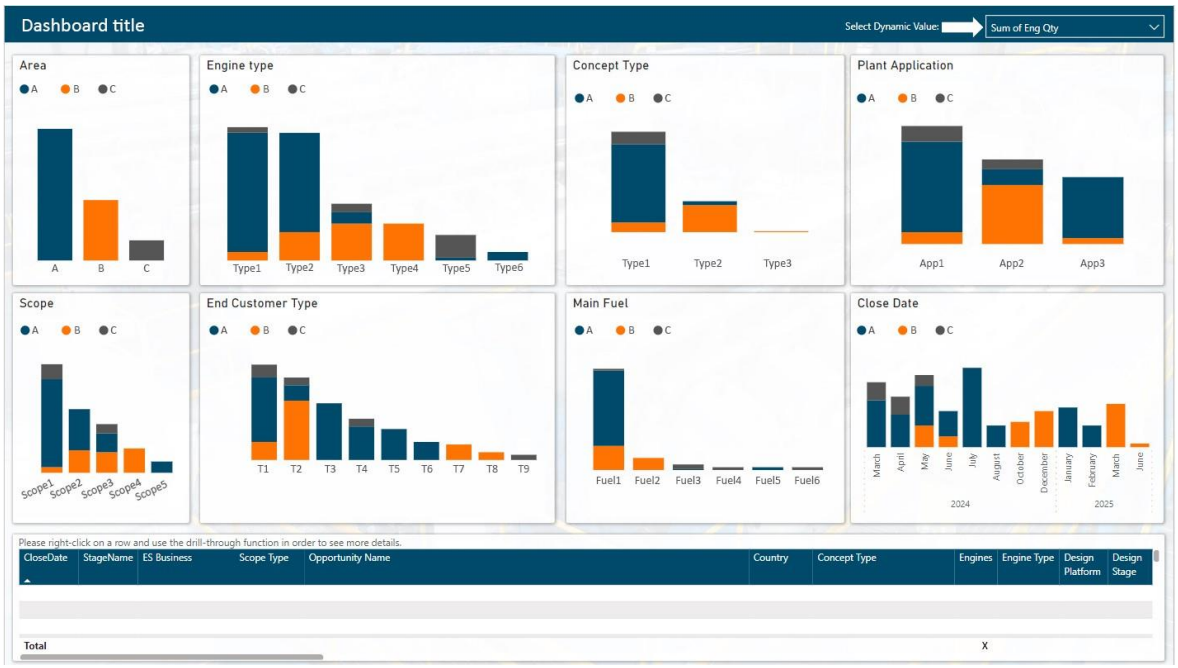


Figure 8: EPP Technology Dashboard (Wärtsilä)

Visual Design

Color Scheme and Graphics: The EPP Technology Dashboard employs a vibrant color palette with various shades of blue, orange, and gray to differentiate data segments effectively. This choice of colors not only helps in distinguishing between different data categories but also enhances the visual appeal of the dashboards.

Typography and Iconography: The typography is clear and readable, with adequate spacing and size that makes it easy to read from a distance. The dashboard does not heavily rely on iconography, which could be seen as a missed opportunity to further enhance visual guidance and reduce text.

Layout

Organization: The dashboard segments data into various categories such as ‘Area’, ‘Engine Type’, ‘Concept Type’, etc. Each section is designed as a separate module, using bar graphs to represent the data. This modular approach is beneficial for comparing specific aspects across different parameters but can quickly contribute to a sense of information overload due to the dense packing of data.

Data Density: There is a high density of information presented, which is typical for a technology dashboard aimed at users needing detailed insights. This could lead to difficulties in quickly finding the most relevant information, especially for those not regularly interacting with such data.

Functionality

Interactivity: The dashboard includes interactive elements such as filtering options that allow users to select specific data points they want to view. For instance, users can filter by ‘Area’, which provides a customized view of the data. This feature is helpful for exploring large datasets effectively but could be expanded to include tooltips or pop-up windows that provide more detailed data insights or explanations of what each metric represents.

Usability

User experience: The dashboard’s complexity is justified by the need for detailed analytics, yet it might benefit from a more guided user experience. Introducing elements such as a dashboard walkthrough or explanatory tooltips can help new users navigate the interface more efficiently.

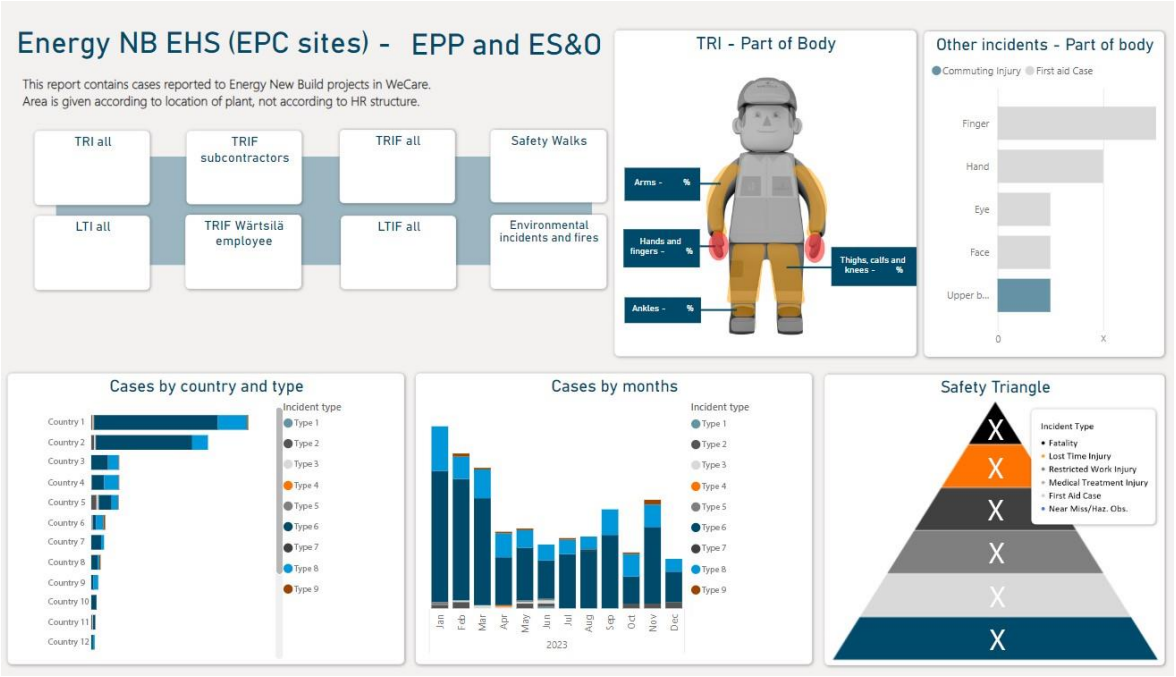


Figure 9: Energy NB EHS (Wärtsilä)

Visual Design

Color Scheme and Graphics: The Energy NB EHS Dashboard uses a simple and professional color palette, primarily featuring blues and grays, which are often associated with trust, calm, and professionalism. This choice is apt for an EHS dashboard where clarity and trustworthiness of information are paramount. The use of graphical elements, ushc as the human figure annotated with injury statistics, is particularly effective. It provides an immediate visual representation of data that could otherwise be complex and clunky to interpret through numbers alone.

Typography and Iconography: The typography is straightforward and easy to read, with a clear hierarchy that helps users navigate through different sections of data easily. The dashboards make minimal use of iconography, focusing more on text and graphical data representation, which maintains a clean and uncluttered interface.

Layout

Organization: The dashboard is well-organized into defined sections. The dashboard uses a mix of bar charts, line charts, and the human figure for visual data representation. This segmentation helps in isolation specific types of information quickly.

Data Density: There is a moderate density of information, with each module spaced adequately to prevent visual clutter. This layout supports easier absorption of the data displayed without overwhelming the user, which is crucial for an EHS dashboard where data accuracy and ease of access can directly impact decision-making.

Functionality

Interactivity: The dashboard incorporates basic interactivity features such as data filters that can be applied across various metrics. More sophisticated interactivity, such as drill-worn capabilities that allow user to view more granular data behind the summaries, would enhance the functionality. Tooltips or hover information could also be added to provide immediate context or definitions for the metrics presented.

Usability

User Experience: The dashboard is designed with user experience in mind, focusing on ease of access to crucial data. Still, there could be an onboarding feature, such as a guide that explains the various components of the dashboard and how to interpret the data represented for new users.

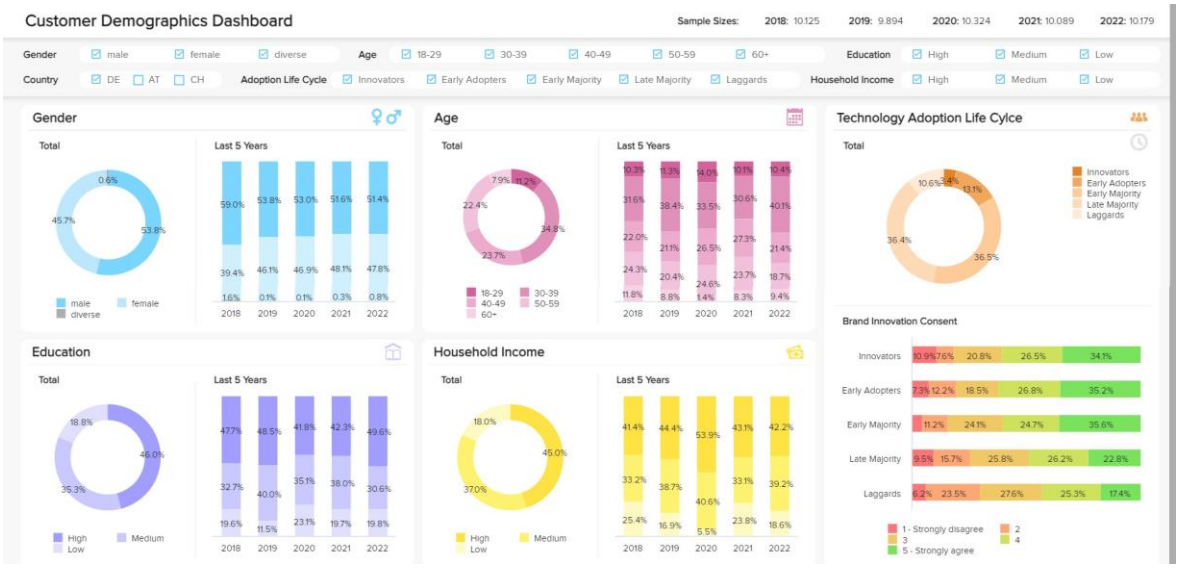


Figure 10: Customer Demographics Dashboard (Datapine)

Visual Design

Color Scheme and Graphics: The Customer Demographics Dashboard utilizes a soft color palette, employing blue, pinks, and yellows to differentiate data segments. This choice of colors is both visually appealing and effective in making distinctions clear without being

overwhelming. The graphical use of pie charts, donut charts, and bar graphs helps in quickly communicating data distributions and trends.

Typography and Iconography: The dashboard uses modern, clean typography that enhances readability. The text is neither too large nor too small, making it easy to read on various devices. Iconography is minimal but used effectively to represent the different categories, aiding in quick visual navigation.

Layout

Organization: The layout is exceptionally organized with each demographic category allocated its own section on the dashboard. This segmentation allows users to quickly locate the information they are interested in without searching through unrelated data.

Data Density: The density of information is well-balanced. Each section provides enough data to offer insights without cluttering the view. The spacing between different data visualizations is adequate, preventing the dashboard from feeling cramped.

Functionality

Interactivity: This dashboard offers a good range of interactive capabilities. Users can filter the data by several demographics, which allows for a dynamic exploration of the data sets. Additionally, the dashboard provides sliders or dropdown menus for selecting specific data ranges, making it highly user-centric and interactive.

Usability

User Experience: The dashboard is designed with the end-user in mind, providing a clear and intuitive interface that does not require any technical knowledge to navigate. The interactive elements are straightforward, and the data is presented in a way that is accessible even to those not familiar with data analysis tools.

Figure 11: Daily OOE Dashboard (Datapine)

Visual Design

Color Scheme and Graphics: The Daily OOE Dashboard utilizes a darker background with vibrant, contrasting gauges and bar graphs. This color contrast makes the dashboard visually striking and aids in highlighting key metrics. The use of colored gauges with different hues intuitively signals performance levels, making it easier for users to quickly assess machine status.

Typography and Iconography: Typography is bold and clear, ensuring that labels and numbers are easily readable against a dark background. Minimalist iconography is used to complement the textual information rather than dominate the visual space, keeping the focus on the data.

Layout

Organization: The dashboard is well-structured, organizing data by individual machines. Each machine's performance metrics are displayed in a dedicated panel, maintaining a consistent layout across machines. This modular approach allows for easy comparison across different equipment and quick identification of any anomalies or trends.

Data Density: Each panel is densely packed with information, however, the strategic use of spacing and color helps keeps the data from becoming overwhelming. The dashboard efficiently uses space to provide a comprehensive snapshot of operational metrics without necessitating additional navigation or scrolling.

Functionality

Interactivity: The dashboard includes interactivity such as live updates, reflecting changes in machine performance in real-time. While it effectively displays the current state of operations, it could be enhanced by adding drill-down features that allows users to click on specific metrics for more detailed historical data or trends analysis.

Usability

User Experience: The dashboard is designed to be intuitive, with a clear focus on KPIs critical for daily operations. The visual hierarchy is well-thought-out, directing user attention to the most important metrics first. The consistent layout across different machines makes it easier for users to get accustomed to the dashboard's interface, reducing cognitive load.

Figure 12: Rolls-Royce Energy Management System Dashboard

Visual Design

Color Scheme and Graphics: Utilizes a dark theme with blue and green accents that not only enhances readability but also fits the maritime context. The graphics are sleek and modern, emphasizing clarity and focus.

Typography and Iconography: Features clean, typography that is easy to read. The icons are intuitive, aiding quick recognition of different data categories.

Layout

Organization: The dashboard is organized into clear segments, each dedicated to specific types of information, making it easy to navigate

Data Density: It uses a balance between detail and accessibility, presenting critical data without overwhelming the user, thus allowing for quick data consumption.

Functionality

Interactivity: It incorporates interactivity features through drop-down menus. These menus allow user to select different vessels from the fleet or change the data range for data display, enabling dynamic and user-specific analysis.

Usability

User Experience: The dashboard is designed with the end-user in mind, featuring a logical layout and interactive elements that improve engagement and ease of use. It provides essential data in a format that supports both quick checks and deep dives into more detailed analytics.

4.3.1 Recommendations for a New Dashboard

Visual Design

Aesthetic Consistency: Use a consistent color palette that reflects the brand and is visually appealing. Consider a Balance between contrast and harmony to highlight key information without overwhelming users. A professional and muted color scheme with one or two accent colors works well for distinguishing critical elements.

Clear Typography: Choose clear, readable fonts and maintain consistent font sizes and styles across the dashboard. Use bold and larger fonts for heading and key metrics to guide the user’s focus appropriately.

Purposeful Graphics: Employ intuitive graphics such as gauges, bar graphs, and pie charts where appropriate. Incorporate innovative visual elements, like the annotated human figure

used in the Energy NB EHS Dashboard, to represent complex data more understandably when relevant.

Layout and Organization

Logical Grouping: Organize information into logical sections that reflect the workflow and priorities of the product management team. Use cards or panels for each section, similar to the layout in the Daily OOE Dashboard, to compartmentalize information cleanly.

Modular Design: Implement a modular design that allows for customization and scalability. Different team members may need to access different data, so flexibility in the dashboard configuration can enhance user experience.

Information Density. Manage the density of information to avoid clutter. Provide enough data to be informative but not so much that it becomes difficult to quickly discern trends and key metrics. This requires balancing detail and conciseness.

Functionality and Interactivity

Dynamic Interactivity: Include interactive elements such as filters, dropdown menus, and sliders to allows users to customize views according to their needs, similar to the Customer Demographics Dashboard.

Drill-down Capabilities: Incorporate drill-down features that allow users to click on summary data to access more detailed information. This helps keep the main dashboard view uncluttered while providing deeper insights when needed.

Real-time Data Updates: Ensure that the dashboard can update data in real-time or near-real-time to provide the most current information.

Usability and Accessibility

User Onboarding: Include a help section and tooltips that guide new users through the dashboard’s features and functionalities.

4.4 Data Analysis and Synthesis

This chapter combines everything learned from the literature review, interviews with stakeholders, and comparative analysis to develop a dashboard solution that fits Wärtsilä Energy's product management team.

What We Learned from Literature

The literature review provided several points for creating effective dashboards. Firstly, it emphasized the importance of clarity and accessibility. Dashboards need to present data in a straightforward manner, using charts and graphs that simplify complex information. This ensures that users can easily interpret and act on the data.

Another takeaway was the use of interactivity. Dashboards should allow users to explore data in more depth, helping them gain deeper insights. Features like drill-down, filters, and interactive charts enable users to customize their view, and focus on the most relevant data. This level of interactivity ensures that stakeholders can access the information they need without being overwhelmed by unnecessary details.

Real-time updates also stood out since having the most current data is crucial for making timely decisions. Dashboards that provide live data feeds ensure that users are always working on the latest information, which is essential for responding quickly to changing conditions and making informed decisions.

A user-centric design is essential for efficiency and usability. The design should be intuitive and align with the specific needs and workflows of the users. This means considering the user's journey through the dashboard, ensuring that the most critical information is readily accessible, and that navigation is straightforward. Consistent use of colors, fonts, and layouts helps create a seamless user experience and reduces the learning curve. In addition to these general principles, the literature highlighted several specific dashboard design principles. These include maintaining a clean and uncluttered layout, prioritizing important information, and using whitespace effectively to avoid overwhelming the user. It is also important to structure the dashboard logically, grouping related data together and using visual hierarchy to guide the user's attention to the most critical information first.

Insights from Stakeholder Interviews

Stakeholders within Wärtsilä EPP's Product Management Team use dashboards with varying frequency, ranging from daily to quarterly, depending on their tasks. Key dashboards include Sales Pipeline, EPP Technology, and Project Execution, along with several dashboards used for specialized tasks. They desire features such as trend analysis, forecasting, comparisons to past periods, and drill-down options. Paint points include fragmented data, wide and cluttered tables, difficulty exporting data, and some faulty data.

To create the proposed MVP navigation portal and new dashboards, it is important to address the needs and pain points identified by stakeholders. It should start from designing a clean, intuitive layout that presents data clearly and accessibly. Use a consistent color scheme and clear typography to enhance readability and user experience. The navigation portal should incorporate data from various sources into a single, organized platform, making it easier for users to find and analyze the information they need.

Comparative Analysis

Developing a new navigation portal for Wärtsilä Energy's product management team requires integrating the best features from existing models while addressing their shortcomings.

A clean and minimalist design is essential for creating an effective dashboard. We should use a consistent, intuitive layout with clear visual distinctions between different sections and types of information. For example, contrasting colors can indicate available reports versus those still under development. A gid-based design with uniform iconography helps maintain an organized and visually appealing interface. Aesthetic consistency is also important; using a consistent color palette that reflects the band to highlight key information without overwhelming users. Clear typography with readable fonts and consistent sizes across the dashboard ensures easy interpretation.

Direct access to content allows users to quickly find and engage with the reports they need. To accommodate more complex needs and improve usability, advanced navigation tools could be incorporated. It is important to have a logical grouping of information into sections that reflect the workflow and priorities of the team. Using cards or panels to compartmentalize information cleanly. Each category or report should be clearly labeled and, where possible, accompanied by brief descriptions or tooltips. Purposeful graphics such as gauges, bar graphs, and pie charts should be employed where appropriate.

Developing the MVP

Based on the insights from the literature review, stakeholder interviews, and comparative analysis, several recommendations emerge for developing the MVP navigation portal and dashboards for Wärtsilä EPP's product management team.

Both the navigation portal and dashboard should follow a simple and clear design. This ensures users can easily interpret and act on the data. Maintaining a clean and uncluttered layout, prioritizing important information, and using spacing effectively will prevent users from feeling overwhelmed. Consistent use of color, fonts, and layout will create a seamless user experience and reduce the learning curve.

To help users gain deeper insights, the portal and dashboards should include some form of interactive features such as drill-down options, filters, and customizable views. These elements will enable users to access the specific information they need without being bombarded with unnecessary details. These should either be implemented in the MVP or future enhancements depending on the timeline.

Having the most current data is crucial for making timely decisions. Therefore, the dashboards should include real-time or near-real-time data feeds. This will not be possible for the MVP, due to restricted access to databases, but will be implemented in future enhancements.

The design of the portal and dashboards must be intuitive and align with the specific needs and workflows of the users. This involves considering the user's journey through the interface and ensuring that the most critical information is readily available. Navigation should be straightforward, with logical grouping of related data and clear visual hierarchy to guide the user's attention to the most important information first.

Stakeholders have highlighted the need for features such as trend analysis, forecasting capabilities, comparisons to past periods, and drill-down options. The MVP will not be featuring these because a couple of reasons. One reason is time-restriction, the time allocated for the development is simply not long enough. Secondly, data-restriction and data formatting. As discussed, the current accessible data is imported from an Excel document, which means that it is not continuously updated and it is a snapshot of a period without specific dating. Trend analysis and comparisons to past periods require data collected from similar periods to compare. For example, sales of engine 1 for the month of January 2024 compared to the sales of engine 1 for the month of January 2023. This is not possible with current data access.

A clean, minimalist design with clear visual distinctions between different sections and types of information is key. For example, contrasting colors can be used to indicate available reports versus those still under development. A grid-based design with uniform icons helps maintain an organized and appealing interface.

Direct access to content is important for efficiency, allowing users to quickly find and engage with the reports they need. For future enhancements, incorporating advanced navigation tools such as filters and dropdown menus will improve usability. Logical grouping of information into sections that reflect the workflow and priorities of the team, using cards or panels to compartmentalize information cleanly.

Employ graphics and charts appropriately to help represent data more understandably. Each category or report should be clearly labeled and, where possible, accompanied by brief descriptions or tooltips to provide immediate context.

5 Design and Development of the Minimum Viable Product

The MVP was developed through a combination of stakeholder interviews, comparative analysis, and adherence to established best practices from literature. This approach ensures that the product not only addressed specific user needs but also incorporated effective features identified from the market and academic guidelines.

The design and development of the minimum viable product was made with Power BI. Power BI is a business analytics service by Microsoft. It provides tools for data aggregation, analysis, and visualization, making it useful for projects that require quick insights from complex data.

Figure 13: Background for the MVP

The development process began with a background. The goal was to enhance the visual appeal and create contrast, without overshadowing the data. The chosen background is subtle to complement the data and reinforce the brand. According to the principles outlined in the literature review (Chapter 2, Section 2.1 and 2.3) as well as in the comparative analysis in Chapter 3.

Figure 14: MVP Banner

A banner was added at the top of the page, together with a title and the company's logo. A banner should be positioned so that it complements the dashboard's layout, typically at the top or along the top margin, where it can serve as a header without obstructing data views. The color of the banner together with the logo was used in order to further reinforce the brand. The banner's color is the same as the logo, which is why a shaded version of the logo was chosen. As seen in the comparative analysis (Chapter 4.3) and follows the coloring practices found in the literature review (chapter 2.3).

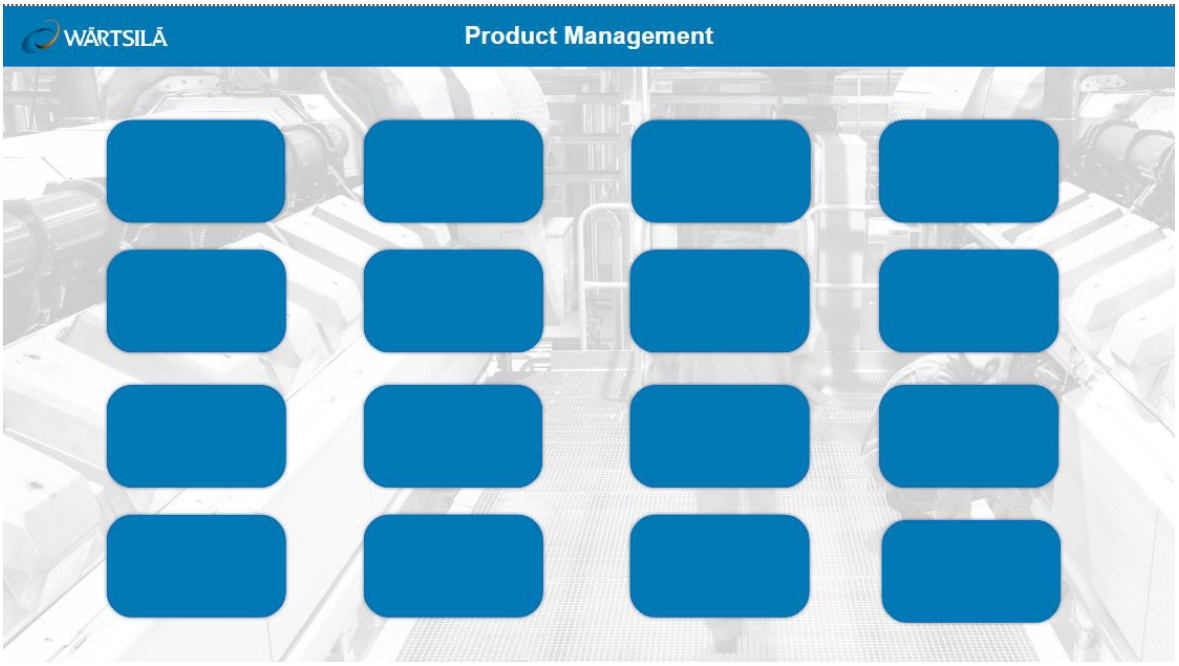


Figure 15: Navigation buttons.

The design of the navigation buttons was planned with the dashboard's ease of use in mind. The shape of the buttons was selected to ensure clear and even separation between each other, reducing visual clutter and making the dashboard simpler to navigate, as discussed in the Literature Review (Chapter 2.3). The color of the buttons was matched with the banner and logo to create a cohesive look across the interface, following the design principles from the Literature Review (Chapter 2.1). This consistency helps users recognize different elements and navigate more easily, as highlighted in Chapter 3.3.

The buttons were also given rounded corners to give them a modern and friendly appearance, which aligns with current design trends mentioned in the Literature Review (Chapter 2.5). Rounded edges make the interface look more approachable and help guide the user's eyes smoothly across the panel, enhancing the overall navigation experience.

Figure 16: Navigation buttons, labeling, iconography, and color-coding.

The labels and icons on the navigation buttons were designed to be clear and intuitive, following the principles discussed in the Literature Review (Chapter 2.1). By using clearly defined labels and easy-to-understand icons, ensure users can quickly grasp what each button does without having to guess. This approach aligns with the user-centered design strategies (Literature Review, Chapter 2.3), which stress the importance of clear communication.

A color-coded system was also implemented to effectively indicate the status of different dashboards, as guided by the insights from Methodology, Chapter 3.4. For instance, a lighter blue color shows that a dashboard is still in development, letting users know that the data or features might not be final. This choice is based on color psychology principles, as detailed in the Literature Review (Chapter 2.4). On the other hand, a lighter grey color indicates that a dashboard is currently unavailable, either due to maintenance or restricted access. This use of color helps users quickly understand the state of the data and enhances navigation efficiency; a strategy also found from the comparative analysis of existing dashboards in the Methodology (Chapter 3.3).

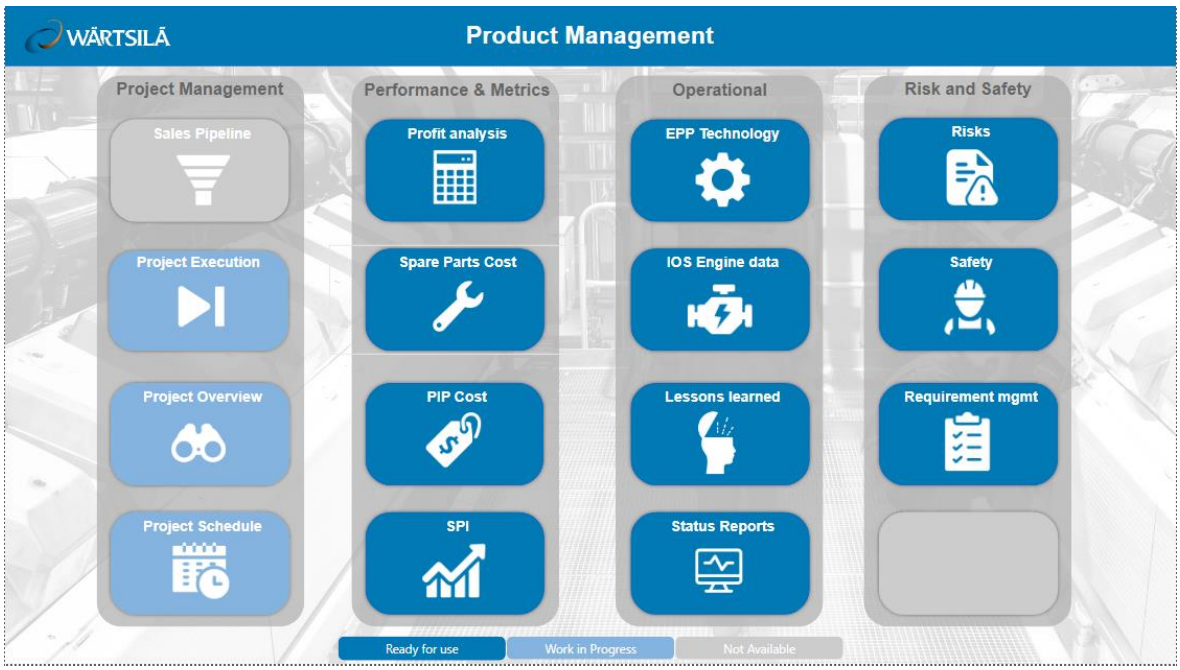


Figure 17: Categorized navigation buttons.

The introduction of categories within the navigation panel was a decision aimed at enhancing both the aesthetic coherence and functional usability of the dashboard, as discussed in the Literature Review (Chapter 2.1). The use of darker grey shapes to visually group related buttons under a unified title directly aligns with best practices in interface design, which emphasize the importance of visual hierarchy and grouping to facilitate quick information retrieval. This principle is supported by literature that highlights how strategic color usage and grouping can reduce cognitive load by helping users navigate more intuitively (Literature Review, Chapter 2.3).

The application of uniform color coding within each category, as detailed in the Methodology chapter (Section 3.2), was influenced by findings from a comparative analysis of existing dashboards. This approach helps to distinguish between groups at a glance, enhancing user orientation and speeding up the process of locating relevant data. The titles above each category serve as quick references that guide users directly to the sections they need, which is a methodological choice based on the findings in chapter 3.2.

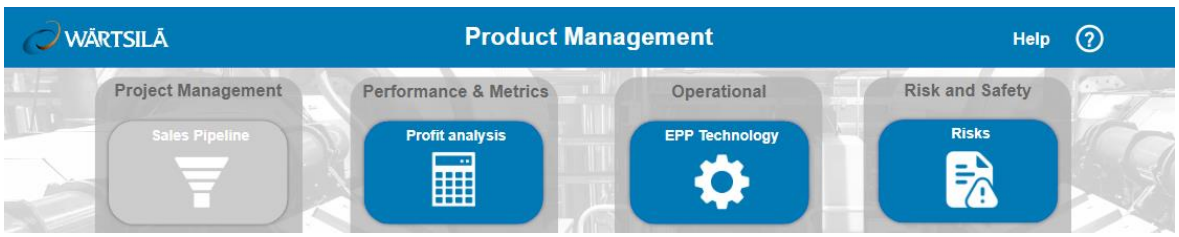


Figure 18: Help button.

To further enhance user support and accessibility within the navigation panel, a help button was incorporated, as recommended in the Literature Review (Chapter 2.3). This feature aligns with the best practices of user interface design, emphasizing the importance of providing on-demand assistance to enhance user experience and facilitate ease of use. The presence of the help button offers immediate access to guidance for navigating through the dashboard's functionalities, effectively addressing user queries and potential challenges.

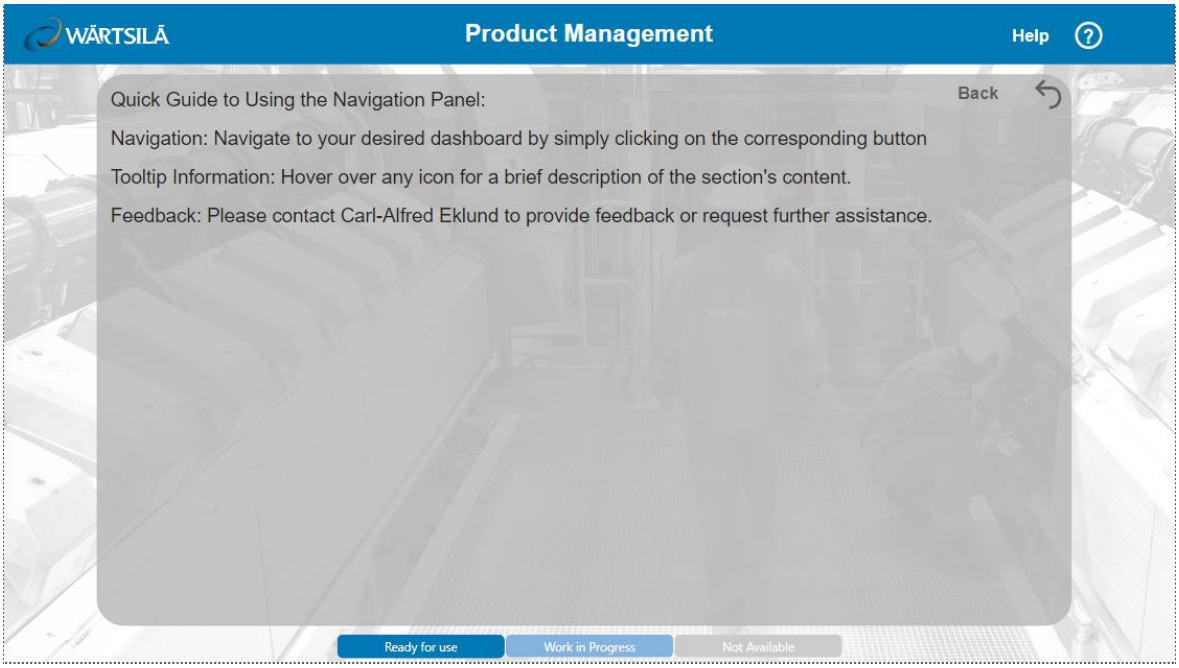


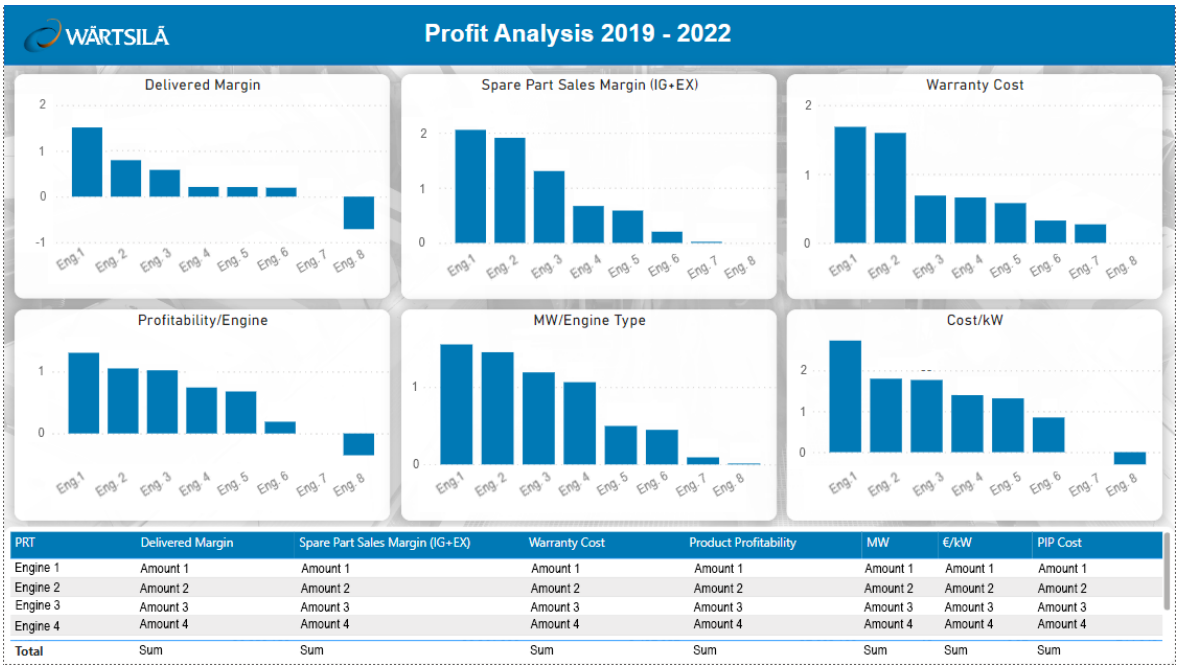
Figure 19: Help page for the navigation panel.

The help page added to the navigation serves as a resource for users, facilitating ease of use and enhancing their overall experience. Positioned prominently within the interface, the help button grants immediate access to this page, which is designed to guide users through the dashboard's various features and functionalities.

Figure 20: Tooltips for the navigation buttons.

The addition of simple tooltips to the navigation panel is an enhancement aimed at optimizing user experience, as underscored in the Literature Review (Chapter 2.3). These tooltips provide immediate, easily accessible information about the contents of each dashboard, supporting the principles of effective data visualization and user assistance discussed in the literature. They appear when a user hovers over any of the dashboard buttons, offering a quick and efficient way to learn essential details about the dashboard's content without requiring the user to click through.

This choice is informed by the methodologies described in Chapter 3 (Methodology, Section 3.4), where the implementation of interactive elements is identified as crucial for enhancing user engagement and facilitating information retrieval. By providing contextual information through tooltips, the navigation panel becomes more user-friendly and also aligns with the best practices for digital interface design.



PRT	Delivered Margin	Spare Part Sales Margin (IG+EX)	Warranty Cost	Product Profitability	MW	€/kW	PIP Cost
Engine 1	Amount 1	Amount 1	Amount 1	Amount 1	Amount 1	Amount 1	Amount 1
Engine 2	Amount 2	Amount 2	Amount 2	Amount 2	Amount 2	Amount 2	Amount 2
Engine 3	Amount 3	Amount 3	Amount 3	Amount 3	Amount 3	Amount 3	Amount 3
Engine 4	Amount 4	Amount 4	Amount 4	Amount 4	Amount 4	Amount 4	Amount 4
Total	Sum	Sum	Sum	Sum	Sum	Sum	Sum

Figure 21: Profit analysis dashboard.

The dashboard uses the same grey-scale background and blue-toned banner used in the navigation portal; a decision rooted in the design principles discussed in the Literature Review (Chapter 2.1). This consistency in design elements across different interfaces is strategic, allowing for a smooth transition between parts of the system, which enhances user experience and reduces cognitive load. This approach is supported by user interface consistency theories which emphasize the importance of familiar visual elements to improve navigation efficiency and reduce errors (Literature Review, Chapter 2.4).

This dashboard introduces new information that is currently not featured on any existing dashboards, highlighting its unique value. The data for this dashboard was extracted from a personal Excel spreadsheet of a stakeholder, containing financial and performance metrics over a limited time period.

The organization of data into clear, distinct sections, represented with bar charts, follows the best practices in data visualization covered in the Literature Review (Chapter 2.3). These visual representations allow for quick comparison across different engine models, improving the dashboard's analytical utility. The inclusion of a detailed table at the bottom of the dashboard provides deeper insights into the numbers for each category, which is a design decision aimed at accommodating users who require more detailed data analysis.

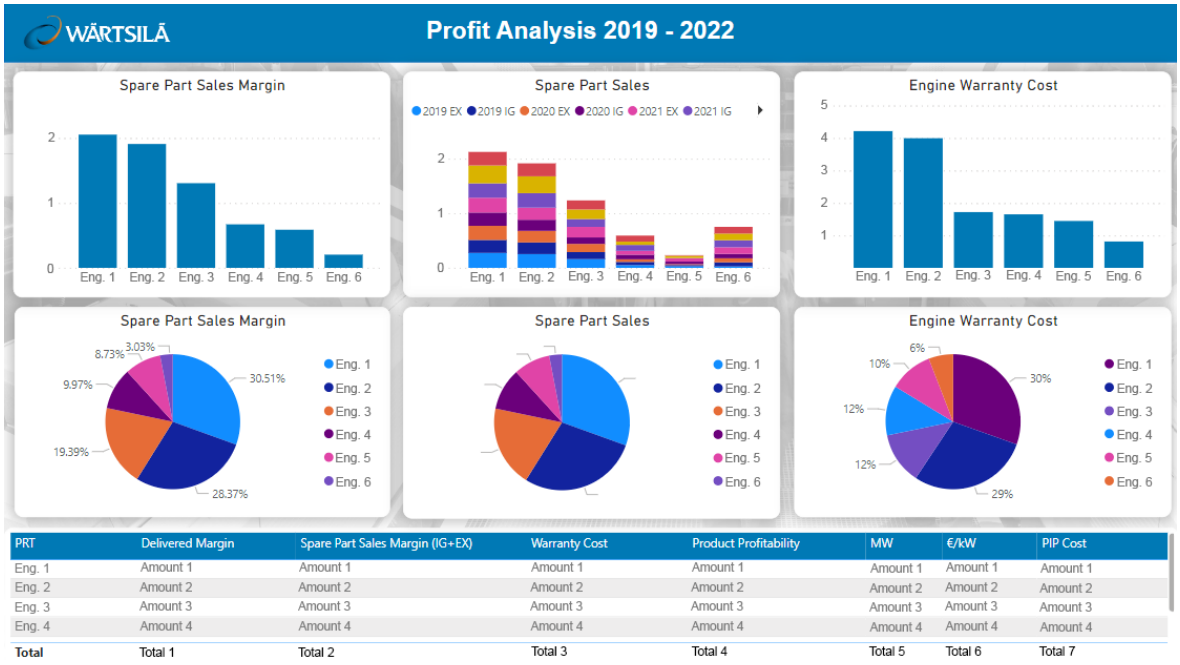


Figure 22: Spare parts analysis dashboard.

The spare parts analysis dashboard continues the visual and thematic style established in the profit analysis dashboard, featuring the same background and banner. This consistency in design, as discussed in the Literature Review (Chapter 2.1), is employed to maintain a cohesive user experience across multiple dashboards.

Additionally, this dashboard introduces new graphical elements such as stacked bar charts and pie charts, as outlined in the Methodology chapter (Chapter 3.3). These visuals are specifically chosen to provide a dynamic representation of data, allowing for a more detailed insight into the performance associated with various engine models. The decision to incorporate these specific types of charts is based on their ability to effectively segment

and display data sets, making it easier for users to interpret trends and comparisons at a glance (Literature Review, Chapter 2.3).

The dashboard also features a summary table located below the visual charts, offering exact numerical data to support the visual insights. This integration of tabular data alongside graphical representation aligns with best practices in data visualization, which advocate for the use of multiple data presentation formats to cater to different user preferences and needs (Literature Review, Chapter 2.5).

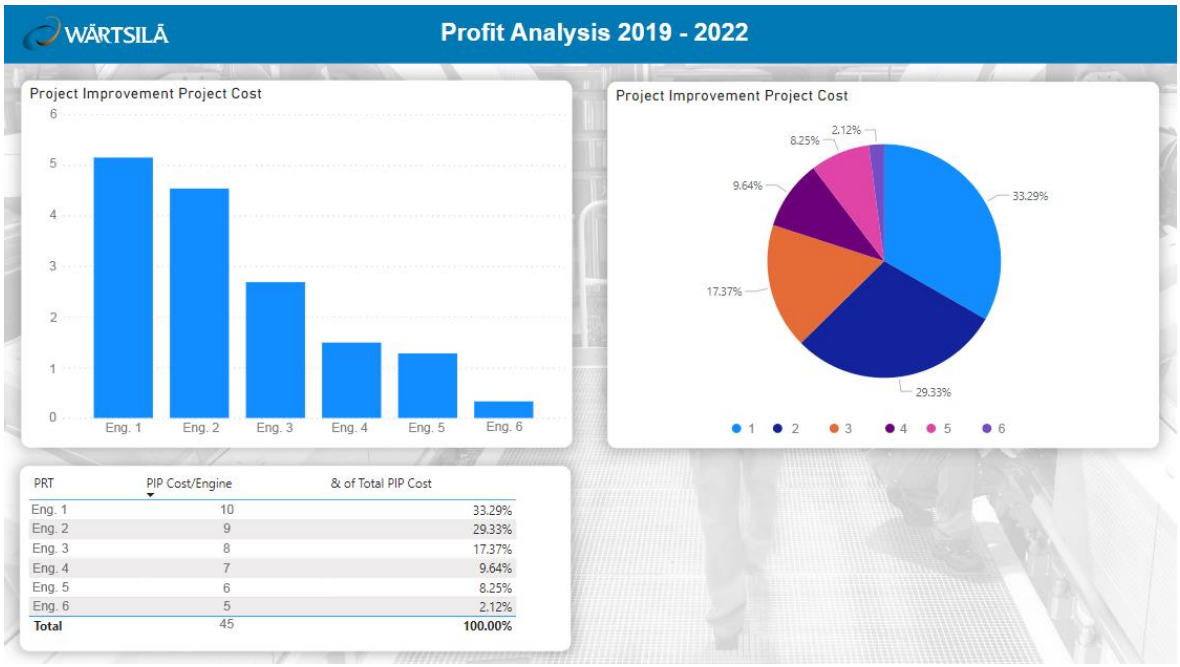


Figure 23: Project Improvement Cost dashboard.

This dashboard represents a continuation of the visual theme established in the previous examples, maintaining the same background and banner. To convey the distribution of project improvement costs across different engine models, this dashboard employs both a bar and a pie chart, a choice informed by the discussions in the Literature Review (Chapter 2.3). The bar chart is used to display the absolute cost figures for each engine model, allowing users to quickly assess which models are incurring the highest and lowest costs. This visualization supports quantitative assessment and enhances decision-making efficiency. Complementing this, the pie chart provides a percentage breakdown of total costs, illustrating the relative financial burden each engine model contributes. This dual-chart approach enables users to gain both absolute and relative perspectives on cost distribution.

This dashboard also includes a detailed data table that offers precise numerical values, reinforcing the visual data presented. This feature aligns with the best practices in data visualization, as discussed in the Methodology chapter (Chapter 3).

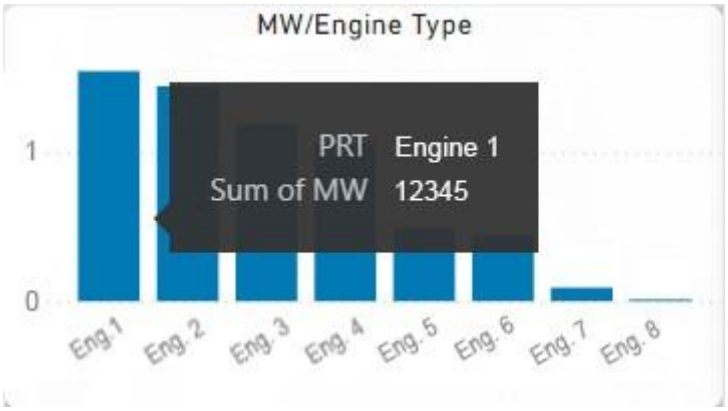


Figure 24: Dashboard tooltips.

Simple tooltips have been integrated across all dashboards; a design choice that aligns with the user-centric principles discussed in the Literature Review (Chapter 2.3). These tooltips provide users with quick, easy-to-access data insights, enhancing the usability of the dashboards without cluttering the visual space. This implementation directly supports the guidelines in data visualization best practices, which emphasize the importance of accessibility and clarity in presenting complex information (Literature Review, chapter 2.5).

The functionality of the tooltips, which appear when a user hovers over any graphical element, is designed to display succinct information about what each visualization represents. This feature is critical in enhancing the user's understanding and engagement with the data, as it allows for immediate contextual insights without the need to navigate away from the current view. This approach is informed by the methodologies in Chapter 3 (Methodology, Chapter 3.3)

6 Results

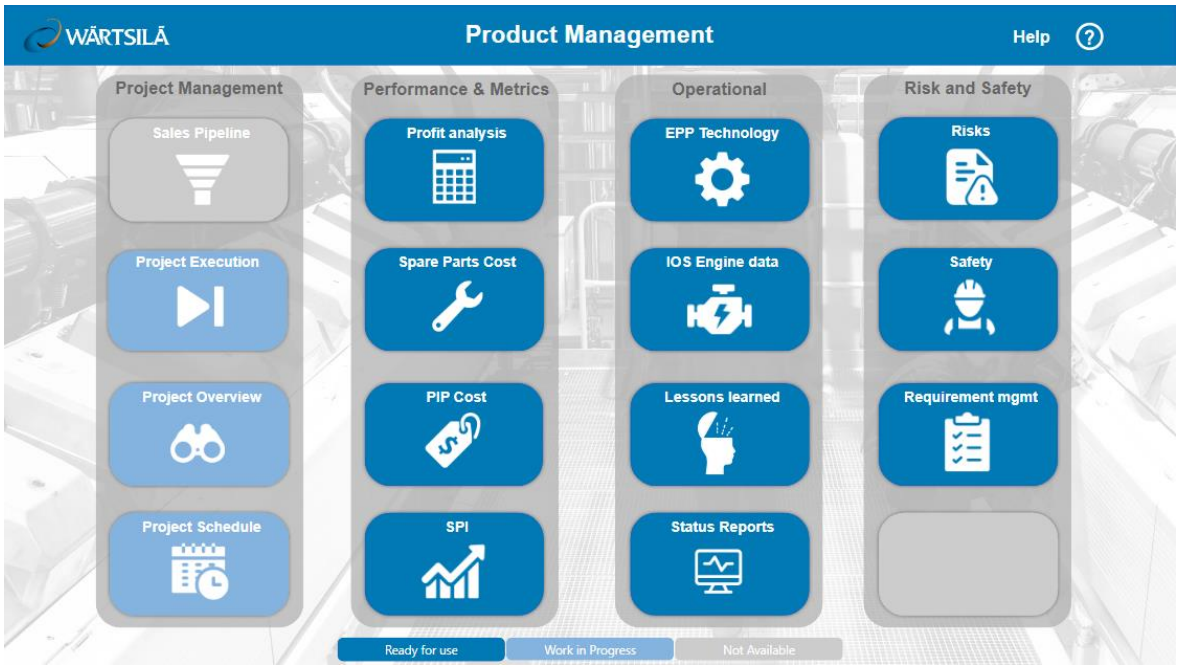


Figure 25: MVP Navigation Panel

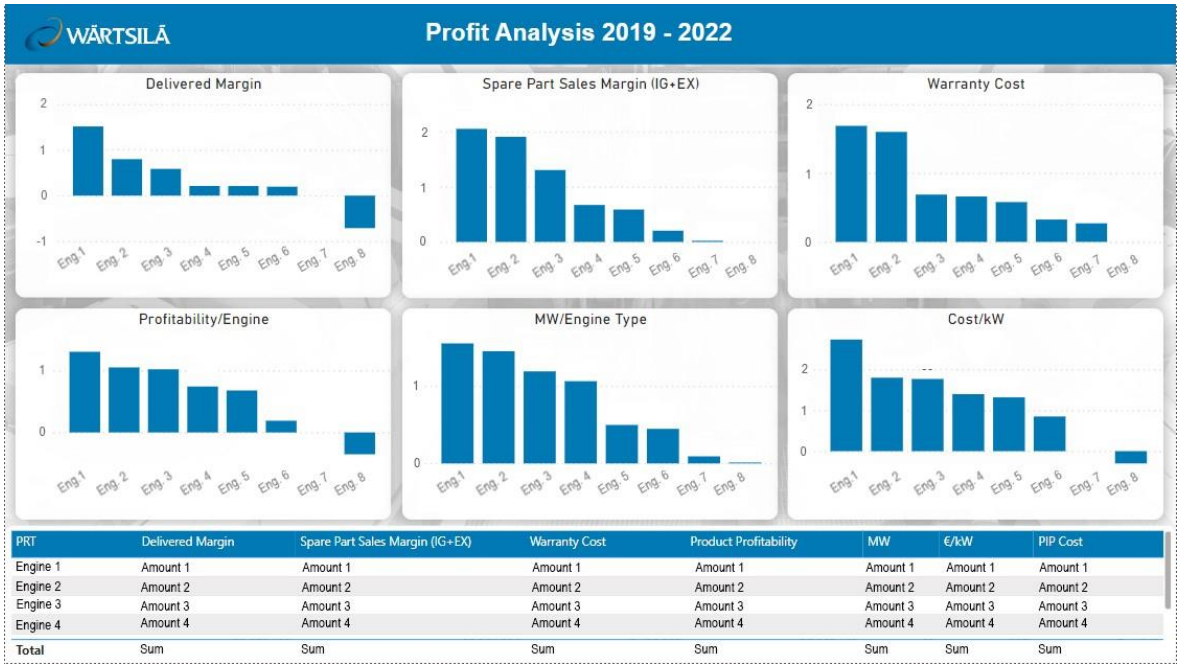


Figure 26: MVP Dashboard

The navigation portal and dashboards created for Wärtsilä EPP's product management team represent a solution designed to meet their needs for managing their product portfolio. This final MVP combines data visualization with a user-friendly interface to enhance operational efficiency.

The core of this solution is a centralized navigation portal that consolidates various data sources into a unified platform. This integration allows users to access needed metrics and information from a single point, streamlining the process of data retrieval and analysis. Each dashboard within the portal is equipped with dynamic features, including interactive features which help users to customize the display to reflect the data they need to analyze.

The dashboards are currently using data gathered from excel spreadsheets, due to access limitations to databases, which means that the data is not able to update in real-time. This is something that will be solved in the future, to ensure that the displayed information is always current and relevant. This is important because timely data can significantly influence decision-making processes.

Features

The navigation panel features a simple layout, from which the user can easily browse their desired dashboard and data. The colors used reinforce the branding and are visually pleasing, while keeping the clarity and usability. The navigation panel also features a lighter blue and a light grey to distinguish the current status of the dashboard linked behind the navigation buttons. Darker grey shapes paired with a title are used to group the destinations into categories by function, reducing search time. The buttons are also ordered by frequency of use. The help button together with a help page was added to aid the usage for less experienced users, equipped with necessary information about the navigation panel and its features, as well as frequently asked questions. Simple tooltips were also used to inform the user about the content of the dashboard, by hovering over the button.

The dashboards follow a similar visual design, with a simple layout and the same color scheme. They are equipped with six graphs and a detailed summary table; the design could accommodate up to eight graphs depending on their content. The graphs use a simple design to keep the focus on the data presented. They feature a title, axis-labels, and data-labels. The title is used to tell what the graph contains, the axis-labels tell what and the value of the columns portray, and the data-labels offer a more precise insight into the value of the column.

The underlying logic of the system’s development was heavily influenced by a user-centered design philosophy, prioritizing ease of use and comprehensiveness. Although the current level of customization is somewhat limited, this aspect is marked for significant enhancement in future iterations.

Future enhancements

Future enhancements for the dashboards are set to introduce a couple of features aimed at enriching the analytics capabilities and providing deeper insights into the data. These enhancements are designed to address current limitations and expand the dashboards' functionality, making them more dynamic and informative.

Enhancing the dashboard's visual effectiveness could be significantly improved by utilizing color more to highlight different data points. Using color selectively can help draw attention to key metrics, differentiate between data categories, and guide the user's eye through information swiftly.

One of the key enhancements should be the integration of trends analysis features, which will allow users to track changes and patterns over time for different engine types and countries. This feature will enable the product management team to quickly identify emerging trends in engine performance and market behavior.

Adding forecasting capabilities to the dashboards will empower users to predict future performance based on historical data. This feature would most likely need algorithms to provide estimates on future sales, costs, and market conditions, helping the team to prepare and adjust their strategies in alignment with project market developments.

Adding the ability to compare current data with historical data to enrich the analysis provided by the dashboards. This feature would enable users to identify significant trends, deviations, or consistencies over time, offering a historical perspective that enhances data interpretation.

Enhancing the dashboards with a data drill-down feature allows users to transition from viewing aggregated data, such as by engine type, to accessing more specific details, like individual engine performance. This capability would address the need for more granular analysis, supporting detailed evaluations and targeted actions based on the data.

These features were not initially included in due to limitations in the existing data infrastructure, which would not have supported such functionalities without potentially compromising the coherence and practical usability of the dashboards. Including these features without the proper data support could have led to inaccurate data representations and underutilization of the dashboard's potential.

The proposed phased approach, starting with a solid foundational dashboard and progressively integrating more sophisticated functionalities, ensures that the system remains robust and user-friendly. Enhancing data collection and processing capabilities will be crucial to support these advanced features effectively. This strategy ensures that each enhancement is both technically feasible and adds real value, keeping the dashboards responsive to the changing needs of the product management team.

7 Conclusion

This thesis aimed to map out the needs for dashboards within Wärtsilä EPP's product management team and develop an MVP for a customized dashboard solution to address these needs. Through a literature review, stakeholder interviews, and comparative analysis, key insights were gathered, leading to the development of an MVP for a navigation portal and dashboards.

Summary of Main Findings

The literature review underscored the importance of clarity, accessibility, interactivity, and real-time updates in dashboard design. Effective dashboards should present data straightforwardly using charts and graphs to simplify complex information, enabling users to interpret and act on data quickly. The inclusion of interactive features like drill-downs, filters, and customizable views can be used to explore data in depth.

The comparative analysis of existing dashboards revealed best practices and common shortcomings. Effective dashboards featured clean, minimalist designs, consistent color schemes, clear typography, and purposeful graphics. Advanced navigation tools and logical grouping of information were identified as useful for improving usability and user experience.

7.1 Challenges

The development of the product management dashboard solution presented several challenges that impacted various stages of the thesis project. These challenges ranged from the initial research phase to the practical aspects of designing and implementing the solution. This chapter outlines these challenges.

One of the early challenges was locating relevant academic literature on a subject that inherently involves a high degree of subjectivity. Product management dashboards are tailored tools that vary widely across different industries and even between companies within the same sector. The literature on best practices and design principles is vast but often generic or not directly applicable to the specific needs of a niche.

The project scope included conducting a series of stakeholder interviews within a limited timeframe. Scheduling and executing interviews with personnel, who themselves are often under time constraints, posed a logistical challenge.

Crafting questions that yield concrete answers beneficial to the project was important. Often in interviews, questions can be too open-ended, leading to broad, non-specific answers that offer little actionable insight. This challenge was compounded when the nature of the topic was unfamiliar to the interviewer. Without a deep understanding of the specific technical details or operational contexts of product management at Wärtsilä EPP, framing questions that elicited useful precise information proved difficult.

Accessing real-life examples of internal product dashboards was challenging due to confidentiality and competitive concerns. Most organizations are reluctant to share details about internal tools that could reveal insights into their operational processes.

Implementing all aspects of the outlined methodology within the constraints of the project was a significant challenge. Each phase of the methodology, from literature review through comparative analysis to the practical design and development of the solution, required thought and time to develop a comprehensive model.

Lastly, deciding what features to implement and what to postpone due to time constraints made the development process more difficult. It was essential to balance the creation of a functional MVP with the comprehensive vision for the foundation that it was meant to be.

7.2 Future Development

The initial development of the MVP solution has laid a foundation for future enhancements. These enhancements are aimed at expanding the solution’s capabilities, improving its analytical power, and further aligning with the needs of the product management team. The proposed enhancements are designed to address the current limitations and to incorporate advanced features that were not included in the initial release due to time constraints and data infrastructure limitations.

Integration of Real-Time Data Updates: Although the current MVP does not support real-time data updates, this feature is a critical enhancement for the future.

Advanced Analytical Tools: Adding capabilities for trend analysis and forecasting to help the product management team anticipate market shifts and align their strategies accordingly.

Comparative Analysis Features: Developing functionalities that allow users to compare current data with historical data over various periods.

Data Drill-Down Capabilities: Enhancing the dashboard with the ability to drill down into more granular data details, allowing users to view data at different levels of aggregation, from broad overviews down to specific details, depending on their informational needs.

Customization Options: Expanding the dashboard's customization options to allow users to tailor the interface and the reports to better fit their individual or departmental needs.

User Interface Improvements: Continuing to refine the user interface based on ongoing user feedback to improve usability and engagement. This may include simplifying the visual design, enhancing navigation, and incorporating more intuitive graphical elements.

7.3 Closing Words

In conclusion, this thesis has mapped out the needs and laid the foundation for a customized dashboard solution tailored to Wärtsilä EPP's product management team. While there are challenges and limitations to address, the insights gathered from literature, stakeholder interviews, and comparative analysis provide a robust basis for continuous improvement. The developed MVP, although not perfect, is a step towards enhancing data accessibility and decision-making capabilities within the team. Future efforts should focus on refining the solution and expanding its features to fully realize its potential.

8 References

Alhamadi, M., Alghamdi, O., Clinch, S., & Vigo, M. (2022, 10 8). Data Quality, Mismatched Expectations, and Moving Requirements: The Challenges of User-Centred Dashboard Design. *NordiCHI '22: Nordic Human-Computer Interaction Conference*.

Dombrowski, U., Schmidtchen, K., & Ebentreich, D. (2013). Balanced Key Performance Indicators in Product Development. *International Journal of Materials, Mechanics and manufacturing, Vol. 1, No. 1*, 106.

Friberg, M. (2024). *EPP Technology*. Retrieved from Wärtsilä Compass: Internal document.

Lenarduzzi, V., & Taibi, D. (2016). MVP Explained: A Systematic Mapping Study on the Definitions of Minimal Viable Product. *42th Euromicro Conference on Software Engineering and Advanced Applications (SEAA)*, 374.

Midway, S. R. (2020). Principles of Effective Data Visualization. *Patterns Volume 1 Issue 9*.

Sarikaya, A., Correll, M., Bartram, L., Tory, M., & Fisher, D. (2019). What Do We Talk About When We Talk About Dashboards? *IEEE Transactions on Visualization and Computer Graphics*, 683.

Tolonen, A. (2015). Product portfolio management – Targets and key performance indicators for product portfolio renewal over life cycle. *International Journal of Produciton Economics*, 468-477.

Tufte, E. R. (1983). *The Visual Display of Quantitative Information.* Cheshire, Connecticut: Graphics Press LLC.

Vásques-Ingelmo, A., García-Peñalvo, F., & Therón, R. (2019). Information Dashbaords and Tailoring Capabilities - A Systematic Literature Review. *IEEE Access, Volume 7*, 109679-109687.

Verhulsdonck, G. (2021). Lean Data Visualization: Considering Actionable Metrics for Technical Communication. *Journal of Business and Technical Communication vol. 35*, 173.

Wärtsilä. (2024). *Energy Storage & Optimization*. Retrieved from wartsila.com: https://www.wartsila.com/energy/solutions/energy-storage

Wärtsilä. (2024). *Engine Power Plants*. Retrieved from wartsila.com: https://www.wartsila.com/energy/solutions/engine-power-plants

Wärtsilä. (2024). *Lifecycle Services*. Retrieved from wartsila.com: https://www.wartsila.com/insights/topics/lifecycle-services

Wärtsilä. (2024). *Our businesses*. Retrieved from wartsila.com: https://www.wartsila.com/about/our-businesses

Wärtsilä. (2024). *This is Wärtsilä*. Retrieved from wartsila.com: https://www.wartsila.com/about

Wärtsilä. (2024). *Wärtsilä Energy*. Retrieved from Wärtsilä: https://www.wartsila.com/energy

Wärtsilä. (2024). *Wärtsilä Marine*. Retrieved from wartsila.com: https://www.wartsila.com/marine

Wärtsilä Corporation. (2023). *Financial Statements Bulletin.* Helsinki: Wärtsilä Corporation.

Wexler, S., Shaffer, J., & Cotgreave, A. (2017). *The Big Book of Dashboards: Visualizing Your Data Using Real-World Business Scenarios.* Wiley.