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Operational Data Analysis and Visualization of PT XYZ Using Business Intelligence Approach with Microsoft Power BI

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Abstract

The study aims to analyze and visualize operational data at PT XYZ, a furniture manufacturing company, utilizing Business Intelligence methods with Microsoft Power BI. A systematic approach was employed, encompassing data import, transformation, cleaning, and visualization, to develop an interactive dashboard that enhances decision-making. Key findings indicate that certain production sections consistently met or exceeded their targets, while others revealed opportunities for improvement. Insights into service wage distribution, standard time requirements, and target realizations were derived from the dashboard. The research identified sections with high service wages and highlighted areas with elevated standard times, suggesting a need for efficiency enhancements. Recommendations include focusing on underperforming sections and optimizing operations to reduce service wages. The study concludes that the developed dashboard supports data-driven decision-making, ultimately contributing to improved operational performance within the companys.

Keywords: *Business Intelligence; Data Visualization; Microsoft Power BI; Operational Data*

1. Introduction

PT XYZ is an international market-oriented furniture manufacturing company that faces challenges in managing its complex and diverse operational data. This data includes information ranging from production targets and realizations to wage cost details per beach chair model based on standard times for each section. Effective data management is essential to support fast and accurate decision-making processes. To address these challenges, this study aims to analyze and visualize the company's operational data using Business Intelligence (BI) methods through Microsoft Power BI software. By developing an operational data dashboard, the study intends to enable the company to monitor operational performance more effectively, optimize production processes, and support data-driven decision-making with greater accuracy and strategic insight [1], [2].

A dashboard is a data visualization tool that displays key performance metrics (KPIs) and other critical indicators in real time, enabling users to monitor and analyze business performance swiftly. Data visualization refers to presenting data in graphical, diagrammatic, or other visual forms to facilitate understanding and analysis [3]. Business Intelligence summarizes data to provide insights and improve business decision-making quality. While information systems focus on data entry, BI applications specialize in analyzing that data, transforming it into knowledge and understanding for business owners [4], [5].

Power BI is a combination of software, services, applications, and connectors that creates reports and visualizations, serving as a reference for analysis and decision-making by stakeholders. Power BI transforms complex data from multiple sources into understandable information, interactive visuals, and shareable insights [3], [6]. The ETL (Extraction, Transformation, Load) process retrieves data from selected sources, transforms it into a new format according to predefined business processes, and loads it into a system. Furthermore, On-line Transaction Processing (OLTP) refers to systems that process transactions directly via computers connected in a network [4], [7].

This study aims to achieve three main objectives: to develop an interactive dashboard using Microsoft Power BI to effectively visualize the company's operational data, to analyze the dashboard based on the created graphs, and to provide actionable recommendations for the company based on the insights generated from the dashboard [8], [9].

2. Research Method

The research workflow below illustrates the step-by-step process undertaken in this study, starting from problem formulation and objectives, through data preparation and visualization, to analysis and recommendations. This systematic approach ensures a structured methodology for achieving the research goals effectively. The detailed steps are depicted in the following diagram [10], [11]:

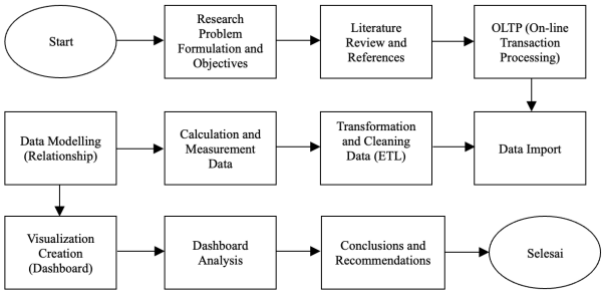

Fig. 1: Research Workflow

2.1. Research problem formulation and objectives

The research problem addressed in this study is: "How can the operational data of PT XYZ be analyzed and visualized to support more effective and strategic decision-making?". The objective of this research is to develop and analyze an interactive dashboard using Microsoft Power BI to visualize operational data and provide actionable recommendations for the company based on the analysis.

2.2. Business intelligence and microsoft power bi

Business Intelligence (BI) is a process of extracting operational data from a company and consolidating it into a data warehouse. This enables management to make decisions based on actual facts rather than relying solely on intuition and quantitative experience. In general, BI aims to provide various information tailored to the needs of each user. This information can originate from multiple sources, such as customer purchase history data, repair history data, and complaint history data. Power BI is an integration of software, services, applications, and connectors. It serves as a tool for creating reports and visualizations, as well as a reference for analysis and decision-making by stakeholders. Power BI transforms complex data from various sources into comprehensible information, interactive visuals, and shareable formats.

Data is the core of Power BI, enabling users to explore datasets, create charts, dashboards, and ask questions through the Q&A feature. All visualizations and insights are derived from datasets such as files, content packs, and databases. Microsoft Power BI offers several key features, including dashboards, visualizations, connectors for SaaS services, live connectivity to SSAS services, and Power BI Designer. The benefits of using Microsoft Power BI include its user-friendly interface, pre-built reports and dashboards for SaaS solutions, real-time dashboard updates, intuitive data exploration with simple language, secure hybrid connections, and rapid deployment integrated with existing IT systems, particularly Microsoft products [3].

2.3. On-line transaction processing

At this stage, the author conducted interviews and documentation (Online Transaction Processing) directly at PT XYZ.

2.4. Data import

The data obtained from the company's database is imported into Power BI using the Get Data feature. This process involves selecting the file format (such as Excel, CSV, or other databases) and adjusting the data structure to fit the analysis requirements.

2.5. Transformation and cleaning data

Data transformation and cleaning are performed using Power Query to ensure that the data used is clean and consistent. This process includes removing duplicates, adjusting data formats (such as dates, numbers, and text), combining relevant tables or columns, and filtering out data that is not needed for analysis.

2.5. Calculation and measurement data

At this stage, the author created calculations and data measures for analysis purposes. Calculations such as total production and average working time per section were made using DAX (Data Analysis Expressions) in Power BI.

2.6. Data modelling

The author created a data model by building relationships between tables based on primary keys such as Art Number or Production Section.

2.7. Visualization Creation

The author created a dashboard displaying various relevant data visualizations, such as Key Performance Indicators (KPIs) to compare production targets and achievements. This dashboard was made interactive by adding filters and slicers.

3. Result and Discussion

In this section, the results and discussions are presented to showcase the findings from the created dashboard. The visualizations and insights derived from the data analysis are discussed to highlight operational performance, compare production targets with achievements, and provide actionable insights for better decision-making.

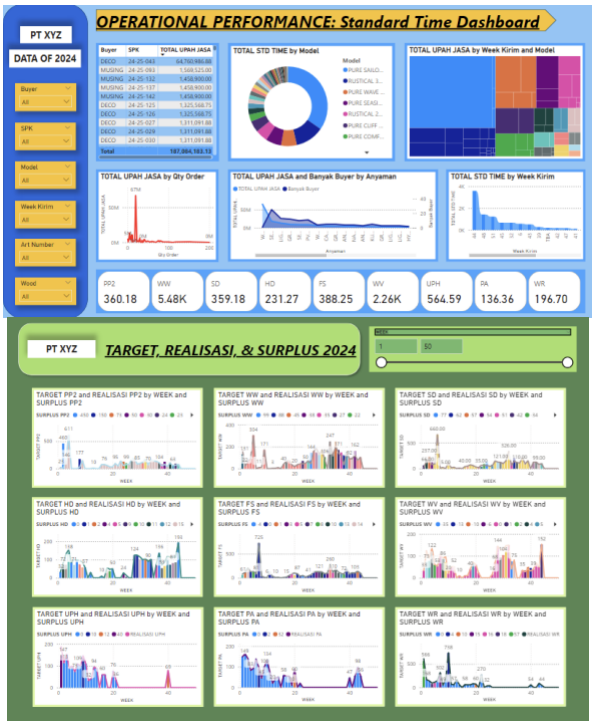

Fig. 2: Operational Data Dashboard

3.1. Operational Performance: Standard Time Dashboard

a) Buyer Table, SPK, and Total Service Wages & Donut Chart of Total Standard Time by Model

Buyer	SPK	TOTAL UPAH JASA
DECO	24-25-043	64,760,986.88
MUSING	24-25-093	1,569,525.00
MUSING	24-25-132	1,458,900.00
MUSING	24-25-137	1,458,900.00
MUSING	24-25-142	1,458,900.00
DECO	24-25-125	1,325,568.75
DECO	24-25-126	1,325,568.75
DECO	24-25-027	1,311,091.88
DECO	24-25-029	1,311,091.88
DECO	24-25-030	1,311,091.88
Total		**187,084,183.13**

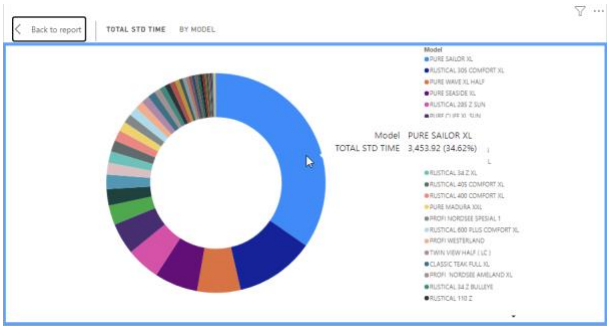

Fig. 3: Buyer Table, SPK, and Total Service Wages & Donut Chart of Total Standard Time by Model

The table visualization of buyers, SPK, and total service wages displays data from each column, which can be sorted by total service wages from highest to lowest by clicking the "Total Service Wages" column header. Sorting from highest to lowest allows the company to identify buyers or SPKs that contribute significantly to the business (the higher the service wages paid to operators, the higher the product's selling price). In the donut chart showing total standard time by model, the legend indicates that there are 78 models produced by the company in 2024. The top 5 models with the highest standard time are: Pure Sailor XL (34.62% of the total), Rustical 305 Comfort XL (11.68%), Pure Wave XL (6.4%), Pure Seaside XL (6.38%), and Rustical 285 Z Sun (4.98%). This visualization helps the company prioritize resources for models that have the greatest impact on total production time.

b) Treemap of Total Service Wages by Shipping Week and Model & Line Chart of Total Service Wages by Order Quantity

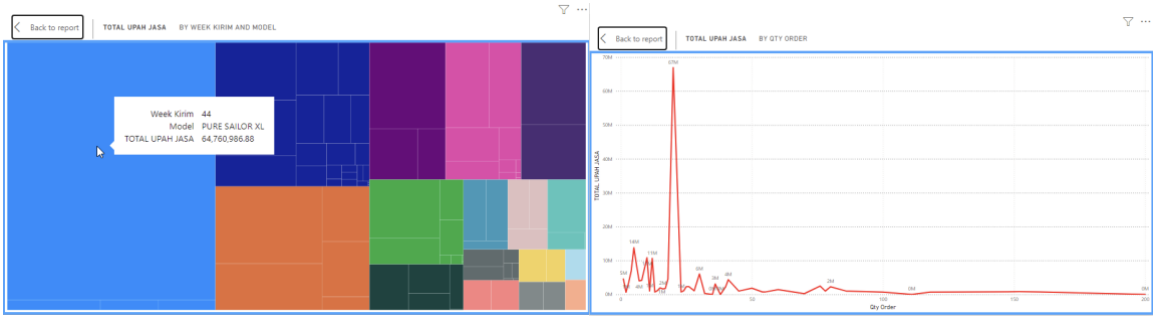

Fig. 4: Treemap of Total Service Wages by Shipping Week and Model & Line Chart of Total Service Wages by Order Quantity

The treemap visualization of total service wages by shipping week and model shows the service wages for each model and week. The colors represent the shipping weeks, and the segments within each color indicate the models to be shipped in that week. The size of each segment reflects the total service wages allocated for producing that model. Details on the shipping week, model, and service wages can be viewed by hovering over the treemap. In the line chart showing total service wages by order quantity, the top 5 order quantities with the highest service wages are: QTY 20 with Rp 66,908,300; QTY 5 with Rp 13,798,882; QTY 10 with Rp 10,844,328; QTY 12 with Rp 10,641,262; and QTY 30 with Rp 6,039,472.

c) Area Chart of Total Service Wages by Number of Buyers and Weaving & Ribbon Chart of Total Standard Time by Shipping Week

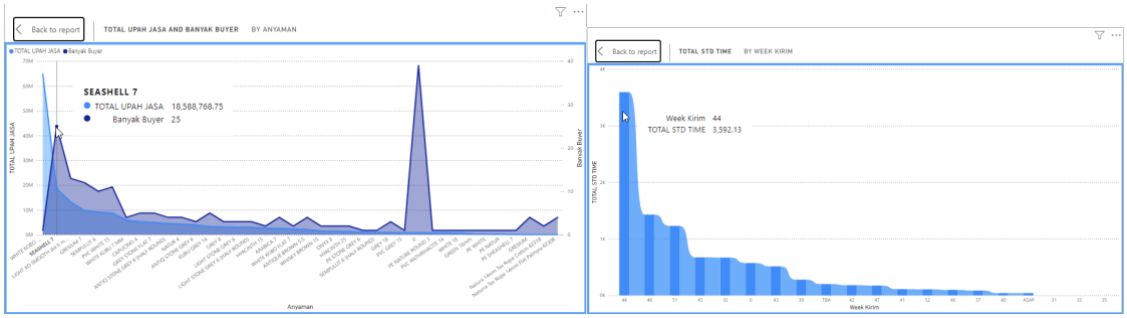

Fig. 5: Area Chart of Total Service Wages by Number of Buyers and Weaving & Ribbon Chart of Total Standard Time by Shipping Week

The area chart visualization of total service wages and the number of buyers or SPKs by weave shows the total service wages and the number of buyers (which can be duplicated) for each weave type. The top 5 weaves with the highest total service wages are: White Kubu 5.5 with Rp 64,760,986 (1 SPK), Seashell 7 with Rp 18,588,768 (25 SPKs), Gresium 7 with Rp 9,672,618 (12 SPKs), PVC White 15 with Rp 8,744,814 (11 SPKs), and White Kubu 7 mm with Rp 5,946,225 (4 SPKs). The ribbon chart visualization of total standard time by shipping week displays the weeks with the highest to lowest standard time requirements. Weeks with the highest standard time demands include week 44 with 3,592.13 hours, week 48 with 1,426.66 hours, week 51 with 1,227.98 hours, week 45 with 671.62 hours, and week 32 with 667.11 hours.

d) Card of Total Standard Time per Section

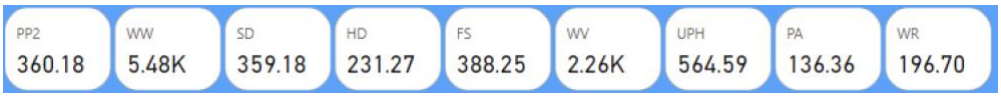

Fig. 6: Card of Total Standard Time per Section

The card visualization of total standard time per section shows that in 2024, each production section requires different amounts of standard time. The total standard time needed for each section is as follows: PP2 requires 360.18 hours, woodworking requires 5,480 hours, sanding requires 359.18 hours, hardware requires 231.27 hours, finishing (staining) requires 388.25 hours, weaving requires 2,260 hours, upholstery requires 564.59 hours, pre-assembling requires 136.36 hours, and wrapping requires 196.70 hours. It can be concluded that the top 3 sections with the highest total standard time are woodworking, weaving, and upholstery.

3.2. Target, Actual, and Surplus 2024

a) Section PP2, WW, and SD

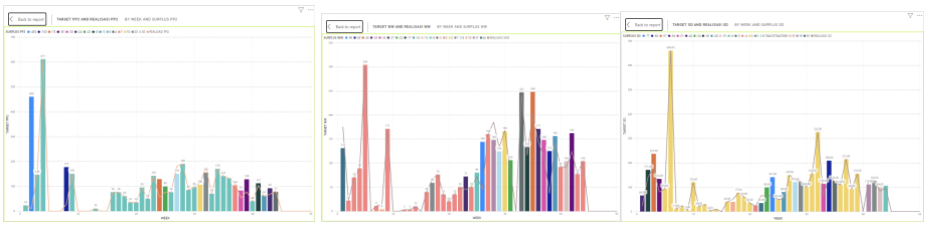

Fig. 7: Section PP2, WW, and SD

The visualization of targets, realizations, and surpluses for sections PP2, WW, and SD shows that there are weeks where the targets were not met. For section PP2, weeks 2, 8, and 24 fell short by -450, -150, and -73, with realizations of 10, 27, and 56, respectively. In section WW, weeks 26, 38, and 35 did not meet their targets, falling short by -99, -88, and -45, with realizations of 45, 37, and 203, respectively. For section SD, weeks 24, 34, and 3 failed to meet targets, falling short by -77, -62, and -57, with realizations of 64, 147, and 180, respectively.

b) Section HD, FS, and WV

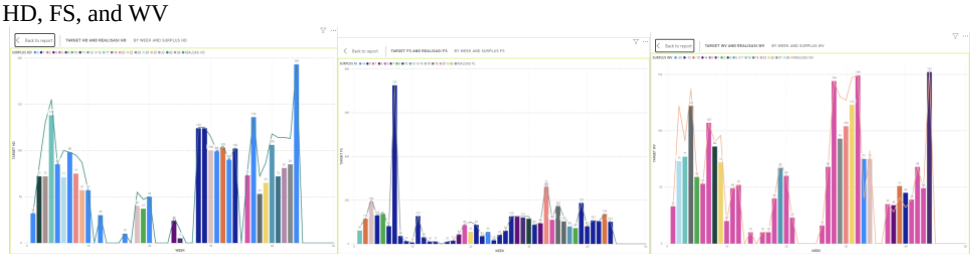

Fig. 8: Section HD, FS, and WV

The visualization of targets, realizations, and surpluses for sections HD, FS, and WV shows varying results. For section HD, all weeks met or exceeded their targets, with weeks 3, 41, and 42 surpassing the targets by +58, +42, and +33, respectively. In section FS, only one week fell short of its target: week 23, which was -4 with a realization of 51. For section WV, there were weeks that did not reach their targets, including week 33 at -35 with a realization of 40, week 40 at -13 with a realization of 32, and week 39 at -10 with a realization of 41.

c) Section UPH, PA, and WR

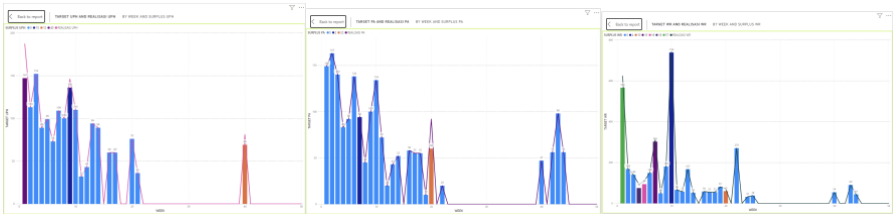

Fig. 9: Section UPH, PA, and WR

The visualization of targets, realizations, and surpluses for sections UPH and WR shows that all weeks met their targets, with some exceeding them. For section UPH, weeks 1, 40, and 9 surpassed the targets by +40, +12, and +10, respectively, while weeks 20 and 7 exceeded their targets by +32 and +12. In section WR, weeks 1, 4, and 5 went beyond their targets with surpluses of +57, +18, and +16, respectively.

4. Conclusion

The results of this research present a comprehensive dashboard for monitoring the company's operational performance. Various data visualizations, including tables, donut charts, treemaps, and charts, reveal the distribution of service wages, standard time, and target realizations for each section. The data highlights that models with the highest service wages include Pure Sailor XL with a total service wage of 34.62% and Rustical 305 Comfort XL with 11.68% of the total. The treemap visualization helps in understanding service wage allocation by model and shipping week, while the line chart identifies the quantity orders with the highest service wages, such as QTY: 20 with Rp 66,908,300 and QTY: 5 with Rp 13,798,882. The area chart shows total service wages based on weaving types, with White Kubu 5.5 having the highest at Rp 64,760,986, and Seashell 7 following at Rp 18,588,768. The ribbon chart highlights shipping weeks with the highest standard time requirements, including week 44 with 3,592.13 hours and week 48 with 1,426.66 hours. The card chart provides the total standard time per section, showing woodworking at 5,480 hours, weaving at 2,260 hours, and upholstery at 564.59 hours as the most time-consuming. The analysis of targets and realizations shows that sections such as HD, UPH, PA, and WR met or exceeded their targets, with week 3 in HD achieving +58 and week 41 in UPH exceeding by +42. Conversely, sections PP2, WW, SD, FS, and WV experienced shortfalls, such as week 2 in PP2 at -450, week 26 in WW at -99, and week 24 in SD at -77. To optimize performance, the company should enhance efficiency in sections with high standard times, such as woodworking, weaving, and upholstery, to reduce service wages. Additionally, addressing underperformance in sections like PP2, WW, and SD will improve production consistency and target achievement. This research offers valuable insights and practical recommendations to support better decision-making and operational performance.

Acknowledgement

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