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Business Intelligence System Design Based on Performance Monitoring Dashboard Using Online Analytical Processing (OLAP) Method

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Abstract. *Key performance Indicator (KPI) report data management system at PT. XYZ is an FMCG company is still not optimal, because it is not integrated, experiences repeated data input, and requires visualization media for monitoring KPI daily meeting level 2 management assembly area. Therefore, a business intelligence system based on performance monitoring dashboard was created for integration, visualization and analysis of KPI data. This research uses a business intelligence roadmap approach without the deployment stage and data analysis using the OLAP method. Based on the results of the evaluation and black box test, it can be concluded that the operations of the OLAP method on the performance monitoring dashboard by their function, run well, and are suitable for use. The resulting visualization helps the monitoring process performance and makes it easier to analyze KPI so that necessary follow-up actions can be executed quickly.*

Keywords: *business intelligence; performance monitoring dashboard; online analytical processing (OLAP).*

I. INTRODUCTION

A key performance indicator (KPI) is a factor in measuring the improvement of a company's performance in achieving its main business goals (Wyk & Wesson, 2021). Every company certainly wants good performance to achieve business goals. One of them is PT. XYZ is a FMCG company in Indonesia. In general, the KPIs in this company are safety, people, quality, efficiency, service, maintenance, environment, and utility. KPIs in this company are monitored through several systems which are then combined with shifty performance tracking reports to track whether the KPIs have reached the target or not. The systems that is focused on in this research is OEE hourly tracking; 5S audit; clean, inspect, and lubricate (CIL) & visual control (centerline) audit; and shiftly performance tracking. The data report management system in the production department especially the assembly area, is still not optimal because it is not yet integrated, experiences repeated data input, and requires media that can visualize performance information effectively and efficiently for monitoring performance. The solution for this problem is designing a business intelligence system based on performance monitoring dashboards.

Performance is the result of the work of each individual or organization to achieve goals and achievement targets (Andriani et al., 2018). A dashboard is a visual display of critical integrated information that can be seen on a single screen (Julio et al., 2023). Dashboard information from data sets for specific business purposes, which can be used to see what's happening and initiate corrective action (Matheus et al., 2020). In this paper, the researcher defines a performance monitoring dashboard as a visual display of performance monitoring information data such as results KPI in assembly area level 2 management and detailed KPI information from 5S audit, OEE hourly tracking, CIL & visual control (centerline) audit system about achieving target, evaluation

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and taking corrective action for further improvements. The dashboard Mahmoodabad et al. (2021) can help managers with continuous data analysis and monitoring of the performance in the pharmacy sector and the dashboard contains KPI information that is important for decision-makers. Researchers hope that this performance monitoring dashboard can help in visualize and monitor performance data so that it can support decision-making process.

This research uses a business intelligence (BI) roadmap approach for a system development method to make a structured project. Business intelligence (BI) concept is the collection, integration, analysis, and visualization of organizational data to support decision-making processes (Bordeleau et al., 2018). The development of business intelligence (BI) has a significant impact on performance measurement in organizations (Vallurupalli & Bose, 2018). Based on Ramadhani and Tania (2020) research the system development to design and implementation of business intelligence uses a business intelligence roadmap approach there are justification, planning, business analysis, design, construction, and deployment phases.

This research focuses on the construction stage for the operational database; extract, transform, and load (ETL) process; data warehouse (OLAP Cube); and data visualization. Data analysis in a data warehouse is carried out after the data has been stored correctly, one of the most popular data analysis techniques in the data warehouse is online analytical processing (OLAP) (Sharda et al., 2018). OLAP is a powerful method for performing data analysis, predictive analysis, complex calculations, and forecasting analysis for business decisions (Mathur et al., 2021). OLAP has several characteristics, namely support multidimensional analysis in real-time, allow users to perform drill-down operations from summarized data to detailed information, roll up from detailed information to summarized data, and provides interactive query analysis facilities (Ain et al., 2019; Barros et al., 2023; Venkatakrishnan, 2020).

II. RESEARCH METHOD

Data Collection

Data collection was carried out through field studies and literature studies. Field studies were carried out by observation and interviews with parties involved in the system. Literature studies are carried out through books, journals, final assignments, and related research. The data used in this research is report shiftly performance tracking data for January 2024 – April 2024, OEE target 2024, assembly area KPI target 2024, detailed list of OEE downtime, calendar 2024, list of production SKUs, list of production machines, standard and audit checklist form 5S, standard and audit checklist form CIL & visual control (centerline) assembly. Creating a dashboard visualization, it is done by inputting dummy data from user trial results by referring to actual historical data.

System Development Method

This research uses a business intelligence roadmap approach, namely justification, planning, business analysis, design, construction without the deployment stage, and uses online analytical processing (OLAP) data analysis methods at the construction stage (Gaol et al., 2020). The first stage of the business intelligence roadmap is justification. At this stage, a business case assessment is carried out by observing/interviewing the parties involved in designing the system, namely level 2 management as the user of the dashboard. At this stage, an overview of the business process, current systems, problem identification, and proposed systems (Destiandi & Hermawan, 2018). The second stage is planning consists of enterprise infrastructure evaluation and project planning (Anardani et al., 2019). Enterprise infrastructure evaluation is carried out by identifying infrastructure within the company. This stage is used so that the project can run and meet needs. Project planning means planning a project and creating a timeline so that the design is completed on time. The third stage, namely business analysis, consists of project requirements definition namely identification of information

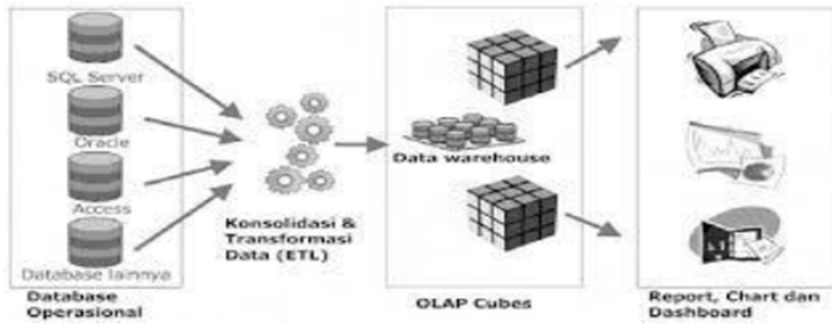


Figure 1. The Process of Business Intelligence

needs that need to be displayed on the dashboard, data analysis namely checking the suitability of existing data in the company with the required data, and application prototyping namely making a dashboard prototype. The fourth stage is design, the database design is carried out by determining the dimension table, fact table, and modeling the data that will be built by creating a star schema, snowflake schema, or fact constellation schema. At this stage, the ETL process design is also carried out.

The fifth stage is construction, at this stage, a dashboard is created according to the business intelligence process concept shown in Figure 1 (Maulana & Wulandari, 2019). The operational database in this research is a data source to create the dashboard. Creation of an operational database for four systems, namely OEE Hourly tracking, 5S audit, CIL & visual control (centerline) audit, shiftly performance tracking and existing operational database namely defect handling. The operational database then enters the extract, transform, load (ETL) process stage using the Power Query tool. ETL is a methodology for consolidating data from multiple queries, and a power query is a powerful tool for refining, cleaning, and covering tasks of ETL in Excel (Pelluru, 2022; Motamedisedeh, 2024). Extract is for collecting data from various query data source, transform is the process of cleaning and transforming data so that it matches the schema in the data warehouse and loading is the process of storing data in the database (data warehouse) (Fana et al., 2021). Next is create the data warehouse using the power pivot tool. The data warehouse has a large amount of data and one of the data analysis techniques in the data warehouse is online analytical processing (OLAP) (Sharda et al., 2018). Designing the OLAP cube is a process to display data in a multidimensional which later the OLAP cube can be used as analysis material for making dashboards. Creating an OLAP cube is by determining dimensions, hierarchy, and measures to to produce calculated values based on the KPI formula (Maulana & Wulandari, 2019). The KPI data is then visualized based on the performance monitoring dashboard which can be analyzed using OLAP method operation.

The dashboard was tested using the black box method that focuses on testing the functionality of the dashboard that has been created to ensure the dashboard can run (Sifaunajah et al., 2022). Black box testing is carried out to find errors in incorrect or missing functions, especially OLAP operation functions. 37 test cases will be tested by expert validators. If the test results do not match the expected results, it is necessary to revise the construction stage.

III. Result and Discussion

Justification

Identifying company business information is carried out by interviewing parties involved in the system. The object company of this research is PT. XYZ is an FMCG company in Indonesia. There are three main areas, namely fermentation, process, and assembly. The focus of this research is the assembly area because it is the place where finished goods are produced and is the initial area where the system needs to be repaired. The assembly area has 7 lines, namely line A to line G.

PT. XYZ divides its production area into 5 portions to make it easier in operational management. The focus of the subject for dashboard users in this research is level 2 management which has responsibility for achieving KPI targets and monitoring the KPIs that have been set so that action can then be taken if problems or KPI targets are not achieved. To form performance report data for daily level 2 management meetings, several supporting monitoring report systems are needed that need to be improved, namely the OEE hourly performance tracking system, 5S audit system, CIL & visual control (centerline) audit system, and shiftly performance tracking system.

OEE hourly performance tracking is a system to find out details of events that cause downtime every hour. This system has problems, namely the detailed data input structure for downtime in one shift is visualized on one spreadsheet sheet so it is difficult to process, determining the downtime category is still an assumption from leader line input so there is a miss in information between field data and reported data, and there is no integration and visualization of all files leader, line, and sheet to monitor and analyze OEE KPIs. The proposed for this system is automating the detailed downtime category classification, and creating integration as well as visualization via the OEE dashboard.

5S is a lean manufacturing tool to helps the company organize, maintain, cleanliness, standardization work, and smoothly function of the work area that consists of sort, set in order, shine, standardize and sustain (Gupta & Chandna, 2020). Monitoring of 5S activities is carried out through 5S audit. This system begins by conducting an audit in a predetermined area via a paper checklist form containing 10 standard points. If there are issues that do not meet the standards, the issue findings are photographed and summarized via the issue findings form. The leader line then plots improvements and inputs the results of improvements to 5S issues. The process of collecting and processing 5S audit data is still manual and not yet integrated and there is no visualization of all files per line to make it easier to monitor and analyze 5S Score KPIs. Therefore, the proposed system is a creation of automatic recaps of 5S issue findings and 5S score calculations, as well as visualization of data from all lines via the 5S audit dashboard.

CIL is one the pillars of autonomous maintenance (AM) in the form of activity cleaning, inspection, and lubrication that operators use to keep lines in basic condition, thereby extending machine uptime. Visual control (centerline) is a standard used to monitor and control line process settings optimally to achieve the best-demonstrated performance. Visual control (centerline) is also created to establish control over existing processes, standardize and simplify machine operations, increase performance reliability, and reduce the number of overall line stops. There are problems with collecting and processing audit data which is still manual and not documented in detail. There is no visualization to make it easier to monitor and analyze CIL KPIs & visual control (centerline) data. The proposed system is a one-gate audit system, calculation of audit values, and visualization of audit value data via the daily control dashboard.

Shiftly performance tracking is a system used to combine level 2 management KPI performance data in shift units. There is a problem, namely the repetition of data input in other systems before it is entered into shiftly performance tracking because it is not yet integrated, and there is no visualization of all KPIs. The proposed system is the integration of KPIs from other systems, namely OEE hourly tracking, 5S audit, and CIL audit & centerline as well as all KPI assembly area level 2 management via the dashboard.

Planning

At this stage, an enterprise infrastructure evaluation is carried out which consists of technical infrastructure evaluation and nontechnical infrastructure evaluation. At the Technical infrastructure evaluation stage, an evaluation is carried out regarding the software and hardware needed, namely computer for hardware. The software required is power query, power pivot, and microsoft excel with Microsoft 365 E3 version 2212 License specifications; microsoft sharepoint with license plan 2;

Tabel 1. Nonthechnical Infrastructure Evaluation

No	System	Table Name	Description
1	OEE hourly tracking (OEE dashboard)	fact_OEE fact_detaildowntime dim_line dim_start dim_date	OEE value data based on time Detailed data for every downtime event Assembly line area name data The clock data corresponds to the input data Detailed company calendar data
2	5S audit (5S dashboard)	fact_audit5sresponses fact_issuetracker dim_auditactivity dim_linearea dim_calender dim_5sname	Input data for each audit activity and 5S audit area 5S audit issue data along with issue resolution progress List of types of audit activities List of 5S audit area divisions from all production areas Detailed company calendar data List of 5S audit checklist types
3	CIL & visual control (centerline) audit (daily control dashboard)	fact_dailycontrol dim_date dim_machine	CIL & centerline value data for each machine and audit Detailed company calendar data List of assembly area machine
4	Shifly performance tracking (performance dashboard)	fact_shifly_performance _assembly 1 dim_sku dim_line dim_date	KPI performance data for management level 2 assembly area List of SKU production in plant List of line area assembly Detailed company calendar data

microsoft one drive with one drive for business (basic) license; google drive, google spreadsheet and tally.so in the web version. At the nontechnical infrastructure evaluation stage, tables needed which are used in designing the dashboard which is shown in Table 1.

Project planning at this stage is used so that the design is completed on time. This business intelligence dashboard was created during 4 months and there is no need to procure infrastructure because the company has collaborated with service providers of data management tools.

Business Analysis

In general in this stage discuss project requirements definition, data analysis, and application prototyping. Project requirements definition in OEE dashboard displays the results of KPI OEE values for OEE components by line, MTBF and MTTR by line, OEE by hour, waterfall OEE in minutes, top 15 downtime duration by machine in minutes, top 5 downtime duration by description in minutes, and list of downtime duration in units of minutes. OEE is measuring the level of effectiveness of using a machine or system by considering several points of view in the measurement (Daman & Nusraningrum, 2020). At PT. XYZ OEE calculation is based on time there is the total value of full rate time compared to scheduled time.

In the 5S dashboard audit, the information needed is the total 5S score, 5S score by line, bottom 10 5S scores by area, issue resolution, 5S radar chart, 5S score trend, bottom 10 issue resolution by area, 5S score list, and issue monitoring list. In the daily control dashboard, the information required is CIL completion, centerline completion, centerline compliance summary of all line, by line, and by machine. In the performance dashboard with combined KPIs from the previous system with the required information safety, quality, OEE, summary, PTP, MTBF, MTTR, process failure, CIL, centerline, 5S score, and waste (kg).

The data analyst stage is checking data quality, namely checking the suitability between existing data in the company and the required data. Because the design of this system involves existing data sources and newly built data sources, researchers only check the quality of data from existing sources in the company. From the checking results, it is necessary to remove duplicate data in the sku_code table and create an ID in each table to be used as a foreign key. In application prototyping stage researcher use microsoft visio professional to design the performance monitoring dashboard.

Design

There are two stages, namely database design and ETL design. When creating a database design, the modeling schema used is determined, namely star schema, snowflake schema, or fact constellation schema. Apart from that, fact tables, dimension tables, measures, and hierarchies are also determined which function to form multidimensional OLAP cube data so that they can be analyzed using OLAP with pivoting, slicing & dicing, drill down & consolidation operations.

The OEE dashboard shown in Figure 2 uses a fact constellation schema because there is a dimension table that is connected to several fact tables (multiple fact tables). In the first fact table fact_OEE is connected to 3 dimension tables, namely dim_line, dim_start, and dim_date. In the second fact table fact_detaildowntime is connected to 3 dimension tables, namely dim_line, dim_start, and dim_date. In the 5S Audit dashboard shown in Figure 3 uses a fact constellation schema because there are dimension tables connected to several fact tables (multiple fact tables). In the first fact table fact_audit5sresponses is connected to 3 dimension tables, namely dim_auditactivity, im_linearea, and dim_calender. In the second fact table fact_issuetracker5S is connected to 4 dimension tables, namely dim_auditactivity, dim_linearea, dim_5sname and dim_calender. The daily control dashboard shown in Figure 4 uses a star schema because there is 1 fact table, namely fact_dailycontrol, which is connected to 2 dimension tables, namely dim_date and dim_machine.

The performance dashboard shown in Figure 5 uses a star schema because there is 1 fact table, namely fact_shiftly_performance_assembly 1, and is connected to 3 dimension tables, namely dim_sku, dim_line, and dim_date. Second stage in the design phase is extract, transform, and load (ETL) design. ETL design that describes the data points that ETL processes. Figure 6 shows the ETL design for designing a business intelligence system based on dashboard performance monitoring.

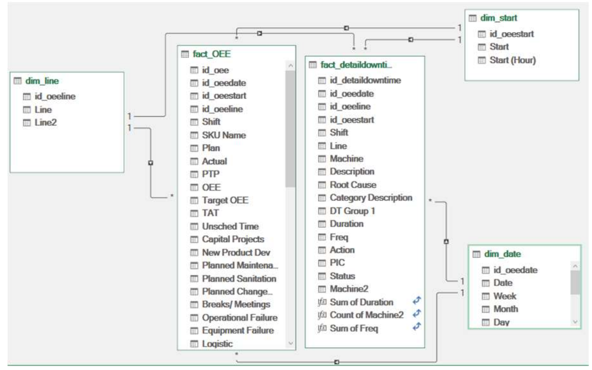


Figure 2. Fact Constellation Schema OEE dashboard

Figure 3. Fact Constellation Schema 5S Audit dashboard

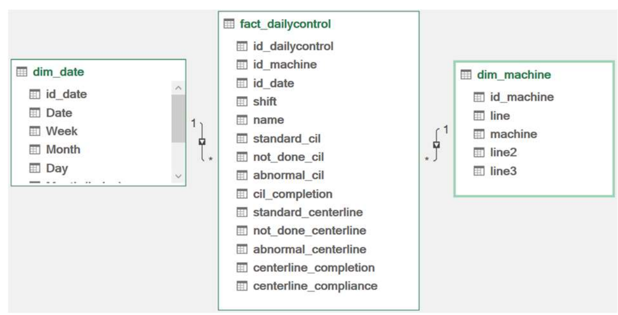


Figure 4. Star Schema daily control dashboard

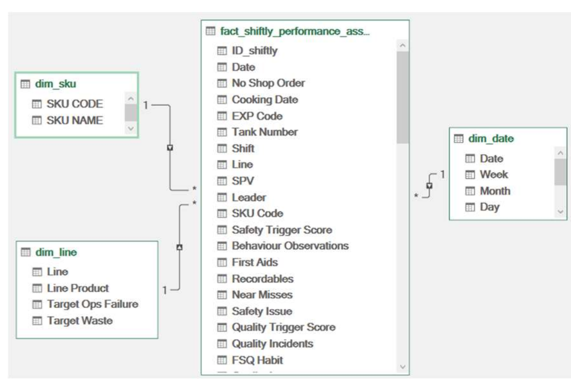


Figure 5. Star Schema Performance dashboard

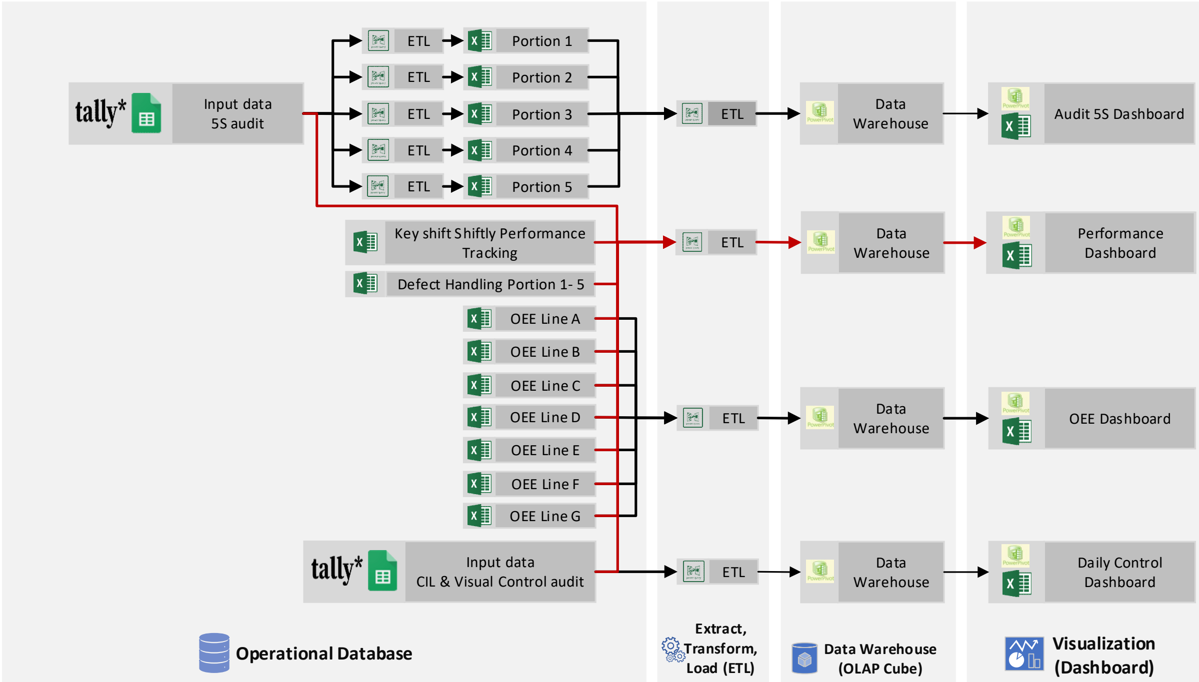


Figure 6. ETL Design

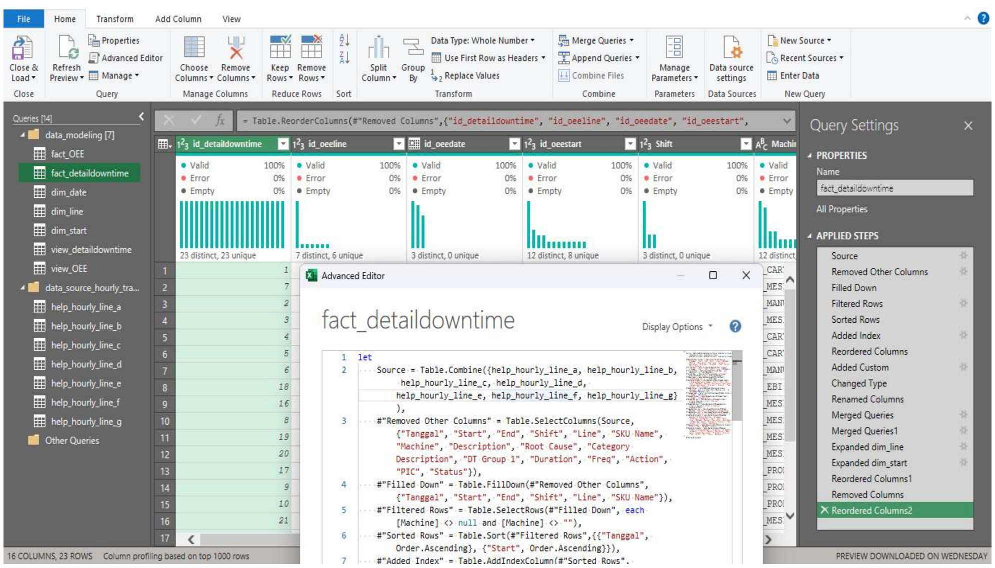
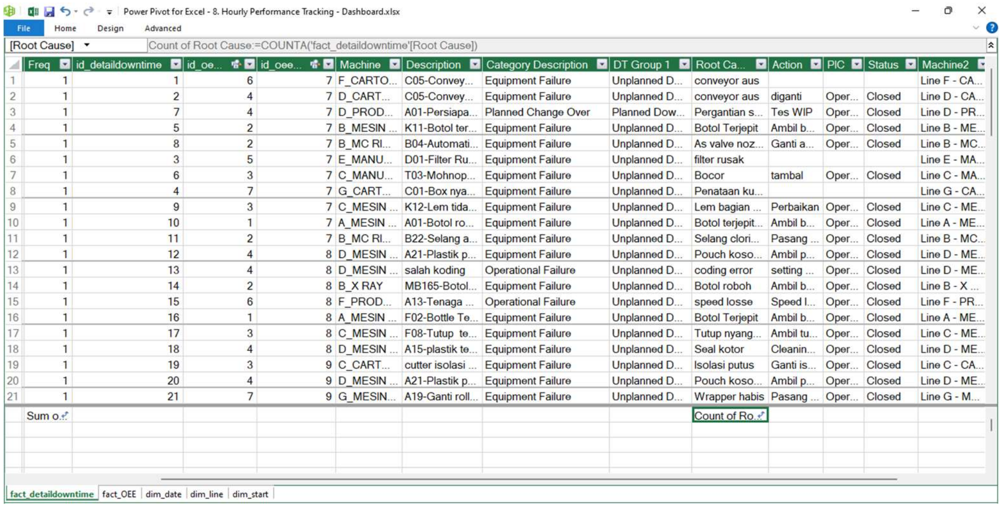


Figure 7. Power Query View for ETL Process

Construction

Making the dashboard starts from the stage of creating operational database from the OEE hourly tracking, 5S audit, CIL & visual control (centerline) audit, and shiftly performance tracking system. In 5S audit and CIL & visual control (centerline) audit come from the data source input field via online form so that a data source database is produced which is initially carried out by recapitulating media audit reports via paper form, and calculating calculations manually with the research operational databases and calculations can be generated in real time. In the OEE system and shiftly data sources are directly input into Excel on the company's SharePoint site.

The data then goes through the extract, transform, and load (ETL) process stages in accordance with the ETL design in Figure 6 with power query tools and the power query-M



Power Pivot for Excel - 8. Hourly Performance Tracking - Dashboard.xlsx

File Home Design Advanced

[Root Cause] Count of Root Cause:=COUNTA('fact_detaildowntime'[Root Cause])

	Freq	id_detaildowntime	id_oe...	id_oee...	Machine	Description	Category Description	DT Group 1	Root Ca...	Action	PIC	Status	Machine2
1	1	1	6	7	F_CARTO...	C05-Convey...	Equipment Failure	Unplanned D...	conveyor aus				Line F - CA...
2	1	2	4	7	D_CART...	C05-Convey...	Equipment Failure	Unplanned D...	conveyor aus	diganti	Oper...	Closed	Line D - CA...
3	1	7	4	7	D_PROD...	A01-Persiapa...	Planned Change Over	Planned Dow...	Pergantian s...	Tes WIP	Oper...	Closed	Line D - PR...
4	1	5	2	7	B_MESIN ...	K11-Botol ter...	Equipment Failure	Unplanned D...	Botol Terjepit	Ambil b...	Oper...	Closed	Line B - ME...
5	1	8	2	7	B_MC RI...	B04-Automati...	Equipment Failure	Unplanned D...	As valve noz...	Ganti a...	Oper...	Closed	Line B - MC...
6	1	3	5	7	E_MANU...	D01-Filter Ru...	Equipment Failure	Unplanned D...	filter rusak				Line E - MA...
7	1	6	3	7	C_MANU...	T03-Mohnop...	Equipment Failure	Unplanned D...	Bocor	tambal	Oper...	Closed	Line C - MA...
8	1	4	7	7	G_CART...	C01-Box nya...	Equipment Failure	Unplanned D...	Penataan ku...				Line G - CA...
9	1	9	3	7	C_MESIN ...	K12-Lem tida...	Equipment Failure	Unplanned D...	Lem bagian ...	Perbaikan	Oper...	Closed	Line C - ME...
10	1	10	1	7	A_MESIN ...	A01-Botol ro...	Equipment Failure	Unplanned D...	Botol terjepit...	Ambil b...	Oper...	Closed	Line A - ME...
11	1	11	2	7	B_MC RI...	B22-Selang a...	Equipment Failure	Unplanned D...	Selang clori...	Pasang ...	Oper...	Closed	Line B - MC...
12	1	12	4	8	D_MESIN ...	A21-Plastik p...	Equipment Failure	Unplanned D...	Pouch koso...	Ambil p...	Oper...	Closed	Line D - ME...
13	1	13	4	8	D_MESIN ...	salah koding	Operational Failure	Unplanned D...	coding error	setting ...	Oper...	Closed	Line D - ME...
14	1	14	2	8	B_X RAY	MB165-Botol...	Equipment Failure	Unplanned D...	Botol roboh	Ambil b...	Oper...	Closed	Line B - X ...
15	1	15	6	8	F_PROD...	A13-Tenaga ...	Operational Failure	Unplanned D...	speed losse	Speed l...	Oper...	Closed	Line F - PR...
16	1	16	1	8	A_MESIN ...	F02-Bottle Te...	Equipment Failure	Unplanned D...	Botol Terjepit	Ambil b...	Oper...	Closed	Line A - ME...
17	1	17	3	8	C_MESIN ...	F08-Tutup te...	Equipment Failure	Unplanned D...	Tutup nyang...	Ambil tu...	Oper...	Closed	Line C - ME...
18	1	18	4	8	D_MESIN ...	A15-plastik te...	Equipment Failure	Unplanned D...	Seal kotor	Cleanin...	Oper...	Closed	Line D - ME...
19	1	19	3	9	C_CART...	cutter isolasi ...	Equipment Failure	Unplanned D...	Isolasi putus	Ganti is...	Oper...	Closed	Line C - CA...
20	1	20	4	9	D_MESIN ...	A21-Plastik p...	Equipment Failure	Unplanned D...	Pouch koso...	Ambil p...	Oper...	Closed	Line D - ME...
21	1	21	7	9	G_MESIN...	A19-Ganti roll...	Equipment Failure	Unplanned D...	Wrapper habis	Pasang ...	Oper...	Closed	Line G - M...
	Sum o...								Count of Ro...				

fact_detaildowntime | fact_OEE | dim_date | dim_line | dim_start

Figure 8. Power Pivot View for Create OLAP Cube

programming language to suit the dashboard information needs, which the power query view can be seen in Figure 7. Next, a multidimensional data warehouse/OLAP cube data warehouse was created using the power pivot tool show in Figure 8 in accordance with the database design. At this stage, measures are also made according to the information you want to display on the dashboard using the data analyst expression (DAX) language. According to Leonard, et al. (2021) the business intelligence framework can use power query and power pivot tools for the extraction, transformation, loading, and analytics processes from various data sources such as files, online data warehouses, and web. The use of power pivot can be used for modeling data with relationships between tables. It is also explained that there are strong analysis features for creating interactive dashboards and are very capable of tracking large amounts of data which in this research is used to analyze performance data using the OLAP method.

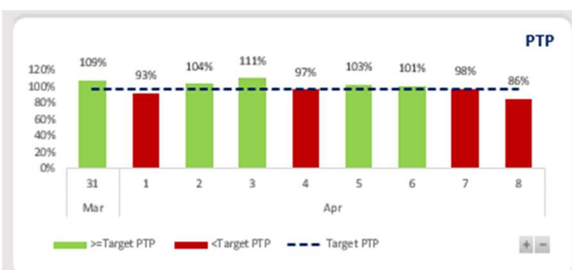


Figure 9. OLAP Operation Drill Down

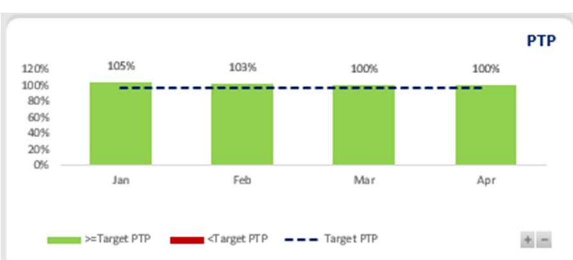


Figure 10. OLAP Operation Roll Up

The final stage in construction is creating a dashboard using multidimensional data analysis using the OLAP method. The operation in this method from Papadaki, et al. (2023) OLAP operations consist of roll up, drill down, slice, dice, and pivot. The results of the drill down operation are shown in Figure 9, namely from the month hierarchy to the most detailed day hierarchy. On the other hand, the results of the roll up operation in Figure 10 from the day to month hierarchy are more summarized. OLAP operations on the performance monitoring dashboard can help with the monitoring process in production and make it easier to analyze KPIs so that any follow-up actions that need to be taken can be executed quickly. OLAP method research was also carried out from Dahr, et al. (2022) found that OLAP operations can help analysts and managers in reviewing sales information from various aspects. Predetermined KPIs can automatically compare and provide indications when critical situations occur.

Figure 11. OEE Dashboard

According to Sharda, et al. (2018) BI is a part of descriptive analytics, the development of which leads to advanced analysis in the form of a combination of predictive analytics and prescriptive analytics. According to Widjaja & Mauritsius (2019) descriptive analytics refers to knowing what is happening in the organization, understanding several trends, and causes underlying these events. Performance monitoring dashboards can be analyzed using descriptive analytics and utilizing OLAP methods. The results of the OEE dashboard design with OLAP Operations shown in Figure 11 show that the KPI OEE performance was 85.9% and achieved the company's OEE target of 85%. However, after looking at the results of pivoting the dimensions per line, it is known that line D still has not reached the target. The cause of OEE not being 100% is the occurrence of downtime with the biggest cause of downtime being equipment failure of 401 minutes or 8.4% with the highest being Line C label machine and category description the highest cause of downtime that needs to be analyzed is glue not coming out of the nozzle on Line C label machine. In the research of Einabadi, et al. (2021) regarding production monitoring dashboards. The difference with this research is that the research uses OEE calculations based on product and involves cost variables with detailed data down to per machine. Meanwhile, in this research, the OEE calculation is based on time without involving cost variables, with the addition of the MTBF value, the level of detail of the data from the time dimension, namely hours.

The results of designing the daily control dashboard are shown in the Figure 12. Obtained performance KPI CIL completion, visual control

Figure 12. Daily Control Dashboard

Figure 13. 5S audit Dashboard

(centerline) completion, and visual control (centerline) compliance yearly, monthly, and daily at 100% and achieved the target of 100%. This dashboard also visualizes the results of pivoting line dimensions using bar charts, month to day hierarchical trends using trend analysis, pivoting line, and machine dimensions. The entire visualization shows 100% performance, which means that all standards agreed upon by management have been carried out and there are

Figure 14. Performance Dashboard

no abnormal findings that cause the inability to carry out activities according to CIL & visual control (centerline) standards.

The results of the 5S audit dashboard are shown in Figure 13. The KPI 5S performance score was 87% with the lowest standard type set in order, known to have achieved the target of 85%. However, on the other hand, there are still lines that are less than the target, namely in the fermentation area, soy process, and syrup process. Judging from the results of pivoting the smaller dimensions, namely the block area specifically for 5S audit activities, 7 areas are still below the target, namely soy sauce process area 1, fermentation area 3, soy sauce process area 1, fermentation area 1, fermentation area 2, line A – Filling, and syrup process area 2. A detailed list of 5S issue monitoring can be seen in the 5S issue monitoring list component.

The results of designing the performance dashboard are shown in Figure 14 with slicers for April - March, weeks 14 and 15, 31-8, and all lines. This performance dashboard visualizes KPI data on safety, OEE, production to planned (PTP), MTBF, MTTR, process failure, namely downtime that occurs due to process failure (not due to machine damage), waste in kg, defect handling, 5S Score, CIL and visual control (centerline) audit. In George's (2018) research regarding dashboard design in performance management in organizations. This research is almost the same as the author's performance dashboard, namely visualizing KPIs from various data sources, and there is a combination of all dashboards which in the research is called the ultimate project performance dashboard. The combination of all these dashboards is used to see a summary of the entire KPI. If you want to see the details of each KPI, you can see the dashboard for each KPI.

The process of designing a performance monitoring dashboard is in line with research by Maulana & Wulandari (2019) which uses the main tools excel, power query and power pivot to process data using the OLAP method and the resulting OLAP method can be used to analyze big data so that you can find out the best shop data in each region. The results of data processing using the OLAP method in the form of graphs and tables can be used and facilitate leaders in making strategic decisions in the future.

Black Box Test Result

Black box testing focuses on testing the functionality of the dashboard that has been created to ensure the dashboard can run as expected. The testing process in the author's research takes the form of testing from expert validators which have an educational background in information management and is an industrial practitioner. This test was carried out with respondents as dashboard users and 37 performance monitoring dashboard scenarios. All scenarios on the audit 5S audit dashboard, overall equipment effectiveness (OEE) dashboard, daily control dashboard, and performance dashboard dashboard are as expected and declared successful. So, it can be concluded that all component functions on the dashboard, including all operations using the OLAP data analysis method, and the function and the dashboard are suitable for use. These results are in line with Wijaya & Ramadhani's (2020) research that black box testing on dashboards can all run and it can be concluded that dashboards can be used to visualize predetermined information. There are suggestions for future research that it is necessary to develop using other business intelligence tools to optimize the data running process.

IV. CONCLUSION

This research produces a performance monitoring dashboard from detailed visualization of KPIs on the 5S audit dashboard, overall equipment effectiveness (OEE) dashboard, daily control dashboard, and a combination of all systems, namely the performance dashboard. This design is intended for level 2 management for monitoring and analyzing KPIs in the assembly area production department. Based on the results of the evaluation it can be concluded that the operations of the OLAP method on the performance monitoring dashboard have been implemented and are running well. The resulting visualization is very helpful for the monitoring process in production and makes it easier to analyze KPIs so that any follow-up actions that need to be taken can be executed quickly. Black box testing as a user dashboard by an expert validator or industry practitioner. From the test results, it can be concluded that all component functions on the dashboard, including all operations using the OLAP data analysis method, are in accordance with their function and the dashboard is suitable for use. Suggestions for future researchers could be to develop dashboard designs with other alternative business intelligence tools.

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