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Implementation of Power BI as Key Performance Indicators Analysis in Monitoring Business Operational Control at PT. Mandiri Harapan Jaya

Muh Anugerah Jufri¹, Syamsu Alam^{2✉}, Valentino Aris³

Universitas Negeri Makassar

Email: alam.s@unm.ac.id^{2✉}

Abstrak

Penelitian ini menyelidiki implementasi Microsoft Power BI sebagai alat analisis Key Performance Indicators (KPI) untuk meningkatkan pengendalian operasional di PT. Mandiri Harapan Jaya. Penelitian ini berfokus pada proyek konstruksi yang dikelola oleh departemen EPC PT. Vale Indonesia Tbk. Data dikumpulkan melalui observasi, wawancara, dan analisis dokumen perusahaan untuk membuat dashboard yang memberikan informasi real-time mengenai kemajuan proyek, kinerja tenaga kerja, keselamatan, dan manajemen biaya. Temuan ini menunjukkan bahwa penggunaan Power BI meningkatkan akurasi data, memfasilitasi pengambilan keputusan lebih cepat, dan meningkatkan efisiensi manajemen proyek. Hasil utamanya mencakup peningkatan produktivitas tenaga kerja, pengendalian biaya yang lebih baik, dan waktu pelaksanaan proyek yang lebih optimal. Penelitian ini memberikan kontribusi terhadap pemahaman teoritis manajemen konstruksi dan menawarkan manfaat praktis bagi PT. Mandiri Harapan Jaya dan industri konstruksi yang lebih luas.

Kata Kunci: *Analisis KPI, Manajemen Proyek Konstruksi, Visualisasi Data, Kinerja Tenaga Kerja*

Abstract

This study investigates the implementation of Microsoft Power BI as a tool for Key Performance Indicators (KPI) analysis to enhance operational control at PT. Mandiri Harapan Jaya. The research focuses on a construction project managed by the EPC department for PT. Vale Indonesia Tbk. Data was collected through observations, interviews, and company document analysis to create a dashboard providing real-time information on project progress, workforce performance, safety, and cost management. The findings demonstrate that the use of Power BI improves data accuracy, facilitates faster decision-making, and enhances project management efficiency. Key outcomes include increased workforce productivity, better cost control, and optimized project execution times. This research contributes to the theoretical understanding of construction management and offers practical benefits for PT. Mandiri Harapan Jaya and the broader construction industry.

Keywords: KPI Analysis, Construction Project Management, Data Visualization, Workforce Performance

INTRODUCTION

Organizational performance is a crucial aspect for achieving sustainable success in business entities or institutions. Performance is defined as the effort to achieve valuable outcomes by individuals or groups working together. According to (Elger, 2007), performance development is viewed as a journey involving a series of steps or stages to improve quality and effectiveness in achieving goals. (Armstrong, 2000) also emphasizes that organizational performance is the result of a strategic and integrated process aimed at achieving sustainable success, involving the improvement of individual and team performance as well as the development of capabilities aligned with the organization's long-term vision and goals.

The implementation of performance evaluation methods is critical in organizational management. One commonly used method is the Key Performance Indicator (KPI). According to (Marr, 2018), KPIs consist of rates, ratios, averages, or percentages to provide more informative and meaningful context in analyzing performance data. KPIs help organizations focus on crucial areas and enable management to identify successes and areas needing improvement. (Eckerson, 2010) argues that KPIs can be integrated into performance dashboards to provide a comprehensive view of organizational performance, encompassing financial, customer, internal process, and learning and growth perspectives.

With the development of information technology, information systems play an essential role in improving organizational performance. (Laudon & Laudon, 2004) define an information system as a structure consisting of interacting elements to collect, process, store, and distribute information to support decision-making and control within an organization. (Turban et al., 2018) explain that information systems must be able to adapt

to dynamic environmental changes to enhance productivity and efficiency through the utilization of information technology. (Westerman et al., 2014) add that information systems enable organizations to respond more quickly to market changes and customer needs through more effective and efficient data management.

Digital business transformation is also a primary strategy for enhancing organizational performance. (Schwertner, 2017) mentions that digital business transformation involves applying technology to design new business models, processes, software, and systems, resulting in increased revenue, competitive advantage, and higher efficiency. According to (Bharadwaj et al., 2013), digital transformation includes the use of digital technology to create new value propositions, improve customer experiences, and enhance business operations. One digital strategy implemented is the use of Business Intelligence (BI). (Boyer et al., 2010) describe BI as a strategic approach that helps organizations understand and leverage their business data effectively, enabling deeper analysis and better decision-making in the digital era.

PT. Mandiri Harapan Jaya, as a local contractor, won the tender for the On Call construction project for PT. Vale Indonesia Tbk., one of the largest nickel mining companies in Indonesia. However, in practice, many organizations, including PT. Mandiri Harapan Jaya, face significant challenges in managing construction projects efficiently and effectively. Common issues include project delays, budget overruns, and a lack of transparency and accuracy in project data. According to (Kerzner, 2017), poor project management is often due to inadequate information systems to support real-time performance monitoring and evaluation. This issue is exacerbated by insufficient data integration, leading to information gaps between management and operational teams in the field.

The application of BI at PT. Mandiri Harapan Jaya aims to improve the efficiency and effectiveness of business operational control through KPI (Key Performance Indicator) analysis. BI allows the company to comprehensively monitor and evaluate operational performance from both financial and non-financial aspects. In this context, Microsoft Power BI is used as a tool to analyze and assess KPIs, helping monitor project progress in real-time and providing a clear picture of project achievements (Agus et al., 2022).

This research focuses on the implementation of Microsoft Power BI in enhancing the effectiveness and efficiency of operational control of construction projects at PT. Mandiri Harapan Jaya. It also evaluates the performance of the information system developed using Power BI in supporting project management. Hence, this research is expected to make a significant contribution to improving the company's operational performance and provide a strong basis for better and more informed decision-making.

RESEARCH METHOD

This research employs an Action Research approach to study the implementation of Microsoft Power BI in enhancing the effectiveness and efficiency of operational control of construction projects at PT. Mandiri Harapan Jaya (Umam & Handoko, 2015). This method involves collaboration between researchers and research subjects to produce systematic improvements through planning, implementation, and evaluation stages. The research location is PT. Mandiri Harapan Jaya, situated in the industrial area of PT. Vale Indonesia Tbk, Sorowako, East Luwu Regency, with research subjects including project managers, project team members, and project engineers directly involved in the implementation of Power BI.

Data collection was carried out through direct observations of operational processes, in-depth interviews with relevant parties, and document collection such as project reports and KPI data. Data were analyzed qualitatively to understand the perceptions and experiences of the subjects and quantitatively to measure performance changes before and after the implementation of Power BI. The validity and reliability of the data were ensured through triangulation of various data sources, member checking, and audit trails documenting the entire research process in detail.

The research procedure begins with the planning of a structured research design to arrange the steps of analysis and implementation of Power BI as a KPI evaluation. Subsequently, data is collected through observations, interviews, and documentation, analyzed using qualitative and quantitative techniques, and then reported in the form of findings, analysis, and recommendations. This approach is expected to provide a comprehensive picture of the contribution of Power BI in enhancing construction project management at PT. Mandiri Harapan Jaya.

RESULT AND DISCUSSION

This research aims to implement Microsoft Power BI as an analysis tool in monitoring Key Performance Indicators (KPI) at PT. Mandiri Harapan Jaya with the hope of enhancing the effectiveness and efficiency of business operational control in construction. The results indicate that data collected from various sources, including project reports, performance data, and interviews with project managers and technical teams, can be integrated with the Power BI system, allowing real-time data access and more effective visualization.

Table 1 System Request

Element	Description
Project Name	Management Information System displaying ongoing projects in the form of an operational control dashboard
Business Need	Facilitate and assist in the data control process and construction project management for more effective and efficient work
Business Requirement	Display reports on one screen, allowing monthly, weekly, and daily views
Business Values	Enhance data transparency and accuracy, speed up decision-making, and contribute positively to efficiency and productivity in project execution
Special Issues or Constraint	The system utilizes Microsoft Power BI and Microsoft Excel designed with analysis formulas

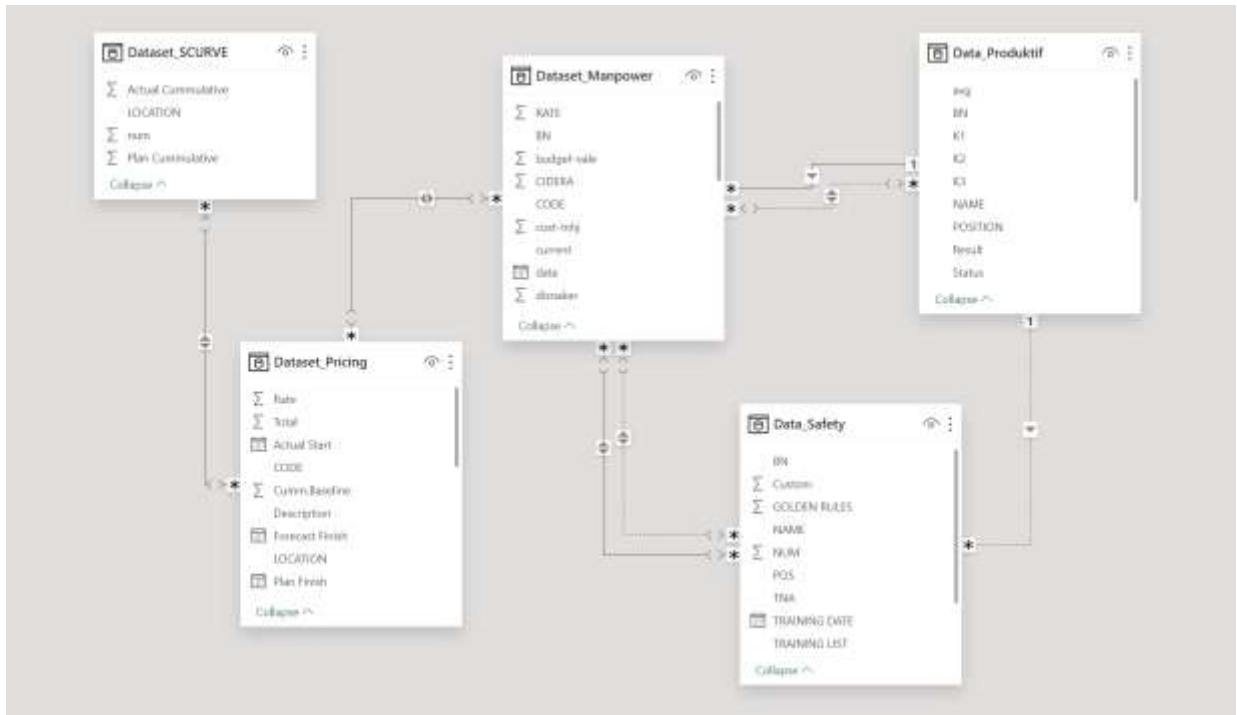
System Request identifies business needs in a sample project that focuses on the primary concern of monitoring organizational performance as expected. By focusing on data efficiency, accuracy, and transparency, this is designed to facilitate data control and construction project management, enhance effectiveness, and provide significant benefits to stakeholders.

The pricing work data agreed upon by the project owner's engineer and the contractor's engineer is cleaned using Microsoft Excel so that the data becomes a new dataset that can be imported into Power BI. During this process, pricing work data validation is performed to ensure the data used is accurate. This prevents data duplication that could affect the price values in the initial data.

Table 2 Validation Results of Work Value Data Accuracy

SUBJECT	Act Total	Result Total	Status	Ratio
ENGGANO OFFICE	1.368.074.239	1.368.074.239	VALID	0%
ENGGANO CANTEEN	371.163.188	371.163.188	VALID	0%
HRTM	1.077.115.070	1.077.115.070	VALID	0%
GHE & Survey Workplace	717.086.182	717.086.182	VALID	0%
FKTP (SOROWAKO)	465.538.890	465.538.890	VALID	0%

Data modeling is performed to arrange and connect the cleaned data into a more organized structure. The goal is to ensure that the data can be optimally utilized in creating visualizations. This makes the data easier to access and analyze, resulting in accurate and informative visualizations.



Picture 1 Data Modeling Results

The dashboard designed in Power BI displays important information such as project progress, workforce performance, safety, and cost management. This data visualization helps management monitor and evaluate project performance more efficiently. The implementation of Power BI enables real-time monitoring of key KPIs, including project costs, completion time, and workforce productivity.

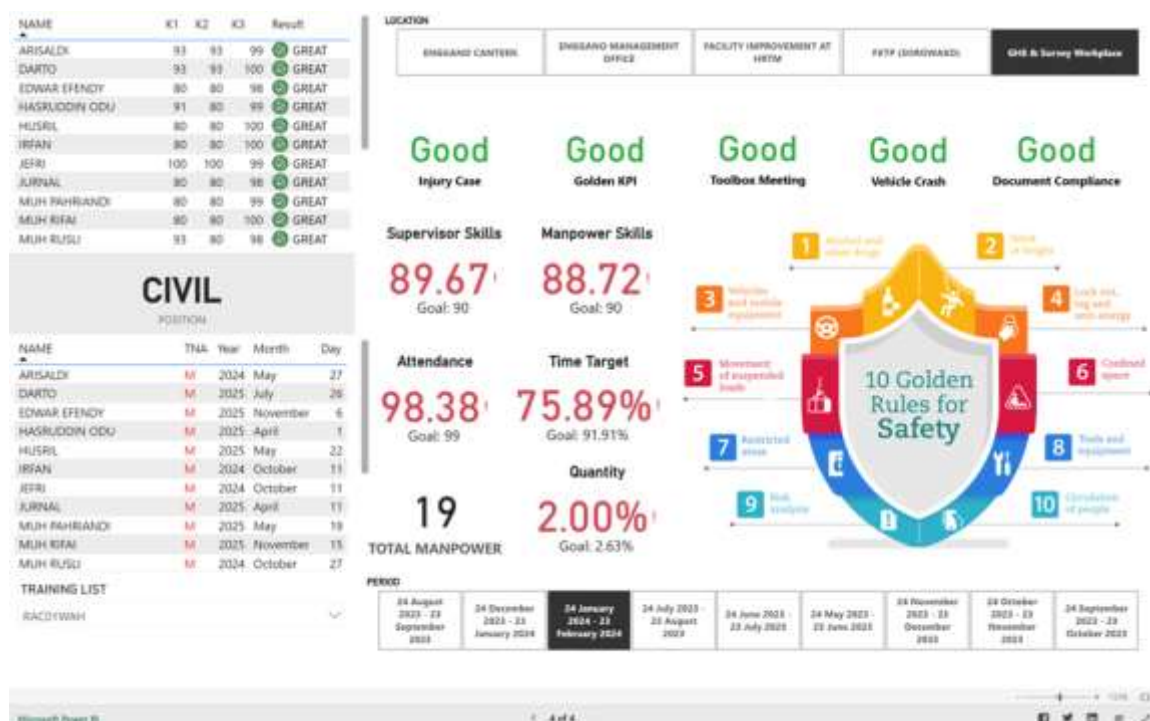


Picture 2 Dashboard Project Performance Results

This dashboard provides a comprehensive visual display of various important aspects of project management, allowing users to select specific project locations through the available slicer.

The main visualizations in this dashboard include a line and clustered column chart comparing the total project costs, overtime costs, and overtime budgets from PT. Vale Indonesia. Additionally, there is an S-curve that facilitates operational project control by assessing performance at each project location. Two additional gauge visuals display project planning and actual work data, providing a clear picture of achievements and deviations from the initial plan.

This dashboard also presents information about the project schedule, including planned start, planned finish, and estimated finish dates in easily understandable information cards. Through measurements of planned and actual values, along with accompanying variance values, users can assess whether the project is on schedule or experiencing delays. Additional data such as project status and schedule provide deeper context for performance analysis and informed decision-making.



Picture 3 KPI Dashboard Results

The results of this dashboard present various key performance indicators (KPIs) that cover critical aspects of project management. Some of the KPIs displayed include the number of injury cases, compliance with safety rules (golden rules), the total number of toolbox meetings held each week, the number of vehicle accident cases, and the total number of safety documents completed.

Additionally, this dashboard displays supervisor performance scores, workforce quality, attendance productivity, percentage of time target achievement, and the average quantity of work completed. By including information about workforce skills and training undertaken, this dashboard provides a comprehensive overview of the readiness and competence of the workforce in the project.

The importance of visualizing the "10 golden rules" in this dashboard is to consistently remind that workplace safety is the top priority. The data presented in the KPI dashboard allows management to track and evaluate project performance comprehensively. This enables them to take necessary steps to ensure the success and sustainability of the project.

The evaluation of the effectiveness of Power BI implementation reveals several key findings. First, the use of Power BI has proven to enhance data accuracy and expedite decision-making processes. This system ensures that the data used for analysis is always up-to-date and precise, which is crucial in dynamic business environments such as the construction industry. Second, the data visualizations provided by Power BI enable management to quickly identify areas that require more attention, aiding in improving workforce productivity and ensuring that resources are allocated effectively. Third, Power BI aids in project cost and time management, enabling companies to avoid cost overruns and ensuring projects are completed on schedule.

Table 3 Results of Black Box Testing

Testing	Task	Expected Outcome	Result	Conclusion
Functional Testing	Clicking on navigation buttons and filters.	All interactive functions on the dashboard are working smoothly without any detected errors.	As expected	Functioning normally
Appearance Testing	Viewing and exploring each visual element on the dashboard.	All visual elements and data presentations look professional and are easy to understand.	As expected	Data interpretation meets requirements
Responsiveness Testing	Accessing the dashboard from various devices.	The dashboard adapts well to various devices without experiencing layout or display issues.	As expected	Accessible across various devices

Performance Testing	Measuring loading and response times when accessing the dashboard.	The dashboard loads quickly without significant delays.	As expected	Quick response time
Error Testing	Providing invalid or unexpected input to the dashboard.	The dashboard provides informative responses and handles errors effectively.	As expected	Incorrect data displayed with "Data not Found" information

The results of Black Box Testing on the PT. Mandiri Harapan Jaya dashboard indicate that all interactive features are functioning properly, with a professional and easily understandable visual display that is responsive across various devices. Performance testing confirms fast loading times, while error handling ensures that the system remains informative and does not fail when receiving invalid input. Overall, the dashboard meets all expected criteria and is ready to be implemented in operational environments for effective project monitoring and analysis.

CONCLUSION

The implementation of Microsoft Power BI at PT. Mandiri Harapan Jaya has enhanced the efficiency and effectiveness of the company's operations. Findings indicate that data analysis tools such as Power BI support construction project management by providing access to real-time data and intuitive visualizations. Management can evaluate project performance and identify risks earlier, enabling better and quicker decision-making. This implementation provides a competitive advantage, improves workforce productivity, and offers better control over project costs and timelines. Power BI has brought significant positive impacts to PT. Mandiri Harapan Jaya's business operations.

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