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Total Quality Management (TQM) Based On Operational Data Quality Control In Improving Managerial Performance At PT Batubara Global Energy

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Abstract

This study uses the concept of Total Quality Management (TQM) to examine the quality control of operational data in the coal trading sector. The internal data governance mechanism at the corporate level is still poorly researched, despite persistent inconsistencies in coal specification data, which include Total Moisture (TM), Total Sulfur (TS), and Ash Content (ASH), posing serious operational risks, such as revisions of export documents, delays in ship departures, and declining buyer confidence. The purpose of this study is to describe PT Batubara Global Energy's current coal specification data quality control procedures, identify the underlying reasons for data inconsistencies, and examine how TQM principles in particular focus on processes, employee engagement, and supplier quality management help improve the accuracy, consistency, and quality of data documentation. During the four-month internship, participatory observation and semi-structured in-depth interviews with three key resource persons of operational workers, a sample specialist, and an operations manager were used to collect primary data for a qualitative case study. The presentation coding reduction methodology of Miles, Huberman, and Saldaña was applied in the thematic analysis of the data. The results showed that PT Batubara Global Energy implemented a layered verification system supported by direct cross-functional communication as the main corrective mechanism and supported by Certificate of Analysis documents, independent surveyor certificates, and ship timesheets. Human error in data entry, delays in the transfer of information from external parties, disruption of government systems, and inherent fluctuations in coal quality during loading are all considered to be the causes of data

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errors. By empirically establishing the application of TQM principles as a framework for operational data governance in export-oriented semi-manual coal trading companies, a context that has not received much academic attention, this study adds to the literature on TQM and data quality.

Keywords: Total Quality Management (TQM), data quality, coal specifications, data quality control, operational management.

INTRODUCTION

In the global energy system, the coal industry remains one of the most strategically important industries, especially for developing countries that largely depend on coal as a high-value export commodity and as a major source of power generation. One example of this dependence is Indonesia, one of the world's largest coal producers and exporters. states that the use of coal that is integrated in the global supply chain still has a significant impact on the economic direction of producing countries. According to coal exports, coal contributes significantly to Indonesia's national foreign exchange earnings, which highlights the industry's position as a pillar of macroeconomic stability as well as a source of energy. A solid system for managing operational data, especially data related to coal volume and quality specifications such as (Wu & Chen, 2018) , Setiawan et al, (2020) *Total Moisture (TM), Total Sulfur (TS), and Ash Content (ASH) values,* that is accurate, consistent, timely, and fully integrated across relevant departments and external stakeholders, will be an ideal choice for coal trading companies involved in international export activities. The integrity of such data is an essential prerequisite for establishing and maintaining trust with foreign customers, in addition to being necessary to guarantee compliance with legal and contractual standards. According to the innovative concept data quality should be assessed based on several aspects, such as truthfulness, completeness, consistency, and timeliness and failure in one dimension can have further consequences on downstream processes and decision-making. (Julinda M Lamers et al., 2023) Wang & Strong, (1996)

However, in reality, the management of operational data in the coal industry has generally not been able to meet these goals. Maintaining the accuracy and consistency of data is an ongoing issue due to the complex and dynamic nature of coal as a commodity, especially its vulnerability to quality variations during the loading, stockpiling and transshipment processes Export documents often need to be revised, ship departures are delayed, and in certain situations, commercial relationships are threatened

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due to differences between the specifications recorded at the outset and the actual quality results at the final loading point. According to factors such as consistency, precision, and completeness are essential to maintain the reliability and ability of data to be operationally acted upon. However, coordination between departments is still disjointed, documentation methods at many coal trading companies are still semi-manual, and the lack of standardized procedures creates systemic vulnerability to human error and information delays The main operational risk that can result in financial losses, regulatory non-compliance, and reputational damage is the mismatch between the ideal conditions of integrated and real-time data management with actual conditions of unstandardized processes that are prone to errors. (Hardianto et al., 2021) Pipino et al, (2002) Redman, (1998)

This research refers to the knowledge that has been developed through academic research on data governance and quality management. According to Total Quality Management (TQM) is an overarching organizational philosophy that centers management practices on customer satisfaction, process orientation, and continuous improvement. These principles apply to the entire organization's assets, including information assets. was one of the first to explicitly support standardized procedures and a culture of accountability, arguing that data quality should be managed with the same rigor as product quality. Recent empirical research from shows that the TQM method is positively and significantly correlated with quality performance outcomes and customer satisfaction levels across a wide range of industries. It shows that system quality and information quality are important factors in determining the effectiveness of management control systems in the context of information systems and organizational performance, which supports the view that data integrity is a strategic issue, not just a technical one. In a similar context, it offers an integrative paradigm for the study of data quality, highlighting the fact that process design flaws, rather than individual errors, are often at the root of quality problems. Demonstrates that Big Data analytics capabilities improve organizational performance in the field of continuous operations management by facilitating faster, more accurate, and effective decision-making. These findings highlight the strategic significance of data quality in modern operations. Particularly in the mining industry, it documents that poor data quality in monitoring and operations data systems leads to significant information loss and decision-making errors, while establishing a direct link between the accuracy of coal quality data and the ability to meet buyer standards and maintain distribution efficiency. Heizer, (2017) Redman, (1998) Anil

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& Satish, (2019) Knauer et al, (2020) Madnick et al, (2009) Stuttgart et al, (2024) Geekiyanage et al, (2021) Pangestu et al, (2023)

In addition, there is an increasing academic interest in the relationship between TQM and Management Information Systems (SIM). Effective quality management must consider not only the physical quality of the product but also the quality of the process and supporting data, as indicated by . It further explains the relationship between data quality, managerial decision-making, and customer satisfaction by showing that the accuracy and reliability of product specification information provided by suppliers has a significant impact on customer satisfaction in the coal sector. shows that the effectiveness of decision-making is directly influenced by the quality of the internal control system, including data verification and reporting procedures, from the perspective of internal control and organizational accountability. TQM procedures are positively correlated with improved quality performance in service-intensive businesses, according to , This conclusion has clear implications for data-intensive operational contexts such as coal trading. Overall, this body of work provides a solid theoretical framework for analyzing TQM-based operational data quality management methods. (Xiao et al., 2019) Rahman et al, (2024) Moreira Monteiro et al, (2021) Talib et al, (2013)

Although the literature is very diverse, there are still a number of significant gaps. First, macro-level quality management at the production stage such as coal classification, equipment maintenance, and safety performance has been the main focus of previous research on TQM in the mining industry. In contrast, the micro-level process of operational data management within coal trading companies has received relatively little academic attention. It is also unclear how TQM principles in particular, a focus on processes, employee engagement, and supplier quality management are used to control the quality of export documentation and specification data in coal trading operations. Second, technologically advanced mining operations using automated data collection systems have been the backdrop for most empirical studies on data quality in the resource industry. This creates a contextual gap for companies that still use semi-manual data management techniques. Compared to highly automated contexts, the risks and mitigation strategies relevant to such situations are qualitatively different. Third, while cross-functional coordination and continuous improvement have proven to be critical to maintaining quality outcomes in the broader TQM literature, the specific ways in which these principles emerge as well as the difficulties encountered in the context of managing coal export data have not been thoroughly examined through enterprise-level qualitative investigations. Fourth, an aspect that is less researched in the literature on supplier

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quality management is the function of external parties as quality assurance actors within the TQM framework for data governance, such as independent surveyors and laboratory analysts. Understanding the structure and management of these interactions directly affects business confidence and operational reliability. (Geekiyanage et al., 2021; Kawilarang & Fitriana, 2024) (Anil & Satish, 2019b; Psomas & Antony, 2017)

By conducting an in-depth qualitative case study of operational data quality control procedures at PT Batubara Global Energy (BGE), a coal trading subsidiary owned by LX International operating in Indonesia, this study answers these questions. The application of TQM principles in this study, particularly focusing on processes, employee engagement, and supplier quality management as an analytical framework to investigate data governance at the operational level within coal trading companies, is its theoretical originality. The use of TQM as a viewpoint to understand data quality management in an export-oriented semi-manual trade environment is a significant theoretical development, although previous research has used the TQM framework in the context of product and service quality. By combining semi-structured in-depth interviews with participatory observations, the study also makes a methodological contribution. This allows for a contextualized and in-depth understanding of the mechanisms that maintain data quality, the sources of inconsistencies that threaten it, and the informal coordination practices implemented by companies in the absence of fully integrated digital systems. This approach overcomes the contextual limitations often mentioned in the literature by placing the analysis in the context of specific organizations and sectors of the coal trade in Indonesia and generating insights that can be directly applied by practitioners working in similar environments across the broader coal and natural resources trade sectors.

The real impact of data inconsistencies in document revision coal export operations, ship delays, administrative burdens, and broken relationships with buyers not only reflect operational inefficiencies, but also significant commercial and reputational risks which is why this study is so urgent. The need to expand the TQM literature and data quality into an organizational environment that has not been widely researched is the basis for its theoretical urgency. This will expand the scope of application of established frameworks and generate new ideas for future research. Therefore, this study aims to achieve three interrelated objectives: (1) to describe the current operational data quality control procedures of PT Batubara Global Energy for coal specification data, (2) to determine the causes of data inconsistencies in coal volume and specification data, as examined through the lens of TQM. principles and, (3) to examine how the application of TQM principles in particular, supplier quality, staff engagement, and focus on processes

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can improve the accuracy, consistency, and quality of recording coal specification data. The establishment of empirical knowledge of how TQM principles function in data governance situations within resource trading firms is an expected theoretical contribution of this study. Its practical contribution is that the study offers evidence-based suggestions for improving data quality management procedures that can be used as a guide by PT Batubara Global Energy and similar companies in the coal and commodity trading industry.

Literature Review

2.1 Data Quality

Data quality is a multidimensional concept that refers to the extent to which data is able to meet the needs of users in supporting operational processes and decision-making. According to the quality of the data is not only determined by accuracy, but also includes other dimensions such as completeness, consistency. timeliness, and relevance. The urgency of data quality management is increasing in resource-based industries such as coal mining, where the data produced from laboratory test results to production data is the basis for determining selling value, operation planning, and compliance with regulatory standards. Wang & Strong, (1996)

In the coal industry, data quality has direct implications for the reliability of information used by various parties, both internal companies and customers. Inaccurate or inconsistent data can lead to errors in the determination of coal specifications, which ultimately has the potential to lead to inconsistencies with the sales contract. emphasizing that data quality dimensions such as Pipino et al, (2002) *accuracy* , *completeness* , and *consistency* are crucial factors in ensuring that data can be trusted and used effectively. When one of these dimensions is not met, then the value of the information generated from that data will decrease.

Along with the increasing use of information systems in operational data management, the challenges in maintaining data quality are also increasingly complex. Data that is manually input as well as generated from an integrated system is prone to errors, delays, or inconsistencies between sources. This is in line with the findings that data quality problems often stem from non-standardized management processes. In the coal industry, this condition can have an impact on inaccurate product quality information received by customers, potentially reducing customer trust and satisfaction in the company. Redman, (1998)

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2.2 Total Quality Management (TQM)

Total Quality Management (TQM) is a comprehensive management approach that focuses on continuous quality improvement throughout organizational processes to meet customer needs. According to TQM, it emphasizes that quality is not only the responsibility of one part, but is the commitment of all elements of the organization. In modern developments, TQM is not only applied to products and services, but also to data management as an organization's strategic asset. This is also in line with the statement that data quality must be managed with the same principles as product quality, namely through a standardized process oriented towards continuous improvement. Heizer, (2017) Redman, (1998)

The application of TQM in the mining industry ensures that the data generated such as coal quality tests, production data, and distribution has a high level of accuracy and consistency. Any error in recording or processing data can be considered as a "defect" that has the potential to cause losses, both in terms of operations and relationships with customers. Therefore, TQM principles such as *continuous improvement, process approach,* and data-driven decision-making are crucial in maintaining data quality. This approach also encourages organizations to not only inspect data, but also improve the process of data collection, processing, and storage systematically.

In addition, the implementation of the PDCA (*Plan Do Check Act*) cycle in data management allows companies to identify the source of data errors on an ongoing basis and take appropriate corrective actions. This is also reinforced by the emphasis on the importance of a process-based approach and continuous improvement in the quality management system. The application of these principles can improve the reliability of the data used in determining product specifications, thereby minimizing inconsistencies with customer contracts and increasing customer trust and satisfaction. Bachren et al, (2025)

2.3 Quality Management and Customer Satisfaction Relationship

According to the implementation of effective quality management focuses not only on the final product, but also on the quality of the process and the information that supports it. Data quality is an integral part of quality management because accurate and reliable data is used as the basis for determining product specifications and meeting customer needs. Customer satisfaction is theoretically the result of a comparison between customer expectations and perceived performance after receiving a product or service. This concept is also in line with the model put forward by those who state that satisfaction

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will be achieved if performance is perceived to be able to meet or exceed customer expectations. So that customer expectations lie not only in the physical quality of the product, but also in the accuracy of the accompanying information, such as data on caloric value, ash content, and sulfur content. Xiao et al, (2019) Rahman et al, (2024)

Inaccurate, inconsistent, or late data can lead to a mismatch between the promised specifications and the actual condition of the product the customer receives. This has the potential to lower the level of trust and customer satisfaction. In addition, research has been conducted which shows that the application of TQM practices has a significant positive relationship for improving quality performance and customer satisfaction. Thus, comprehensive quality management, including data quality, is a key factor in maintaining customer satisfaction. The application of quality management principles supported by accurate and reliable data will increase customer trust and minimize potential product mismatches, thus contributing to the creation of long-term relationships between companies and customers. Talib et al, (2013)

2.4 Management Information Systems (MIS)

According to SIM, it plays an important role in improving organizational efficiency through the provision of accurate, relevant, and timely information. In the coal mining industry, SIM is the main foundation in the management of operational data, such as coal quality data (caloric value, ash content, sulfur), production data, and distribution. The integrated system allows data from various units, such as laboratories, production, and logistics, to be accessed in real time and consistently. However, the effectiveness of a SIM depends largely on the quality of the system, the quality of the information generated, and the level of use by the user. This is in line with the information system success model put forward by those who state that system quality and information quality have a direct influence on the benefits obtained by the organization. Knauer et al, (2020) Jeyaraj, (2020)

In the context of coal data management, it also presents challenges, especially related to data consistency between units and the potential for input errors *(human error).* The research conducted shows that data quality is greatly influenced by the management process in the information system, including data input standards, validation, and quality control applied. In addition, the use of systems that are not fully integrated or are still partial can lead to data duplication and information inconsistencies, ultimately lowering the overall quality of the data. Madnick et al, (2009)

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So that the success of SIM implementation is not only determined by technological sophistication, but also by the alignment between technological, organizational, and human resource aspects. With good information system management, the company can improve the quality of the data produced, thereby supporting more accurate decision-making and increasing customer trust and satisfaction with the coal quality information system presented.

2.5 Continuous Operations Management

Continuous operations management emphasizes the importance of process efficiency, reduction of waste, and data-driven decision-making to continuously improve operational performance. In the coal mining industry, the application of this concept is very important because operational activities involve resource management, product quality, and operational control in a sustainable manner. Data quality is an important element in supporting the success of continuous operations management. Accurate, consistent, and timely data is needed to ensure that operational processes run according to quality standards and production targets become the basis for operational decision-making and meeting customer needs. According to the application of Kawilarang & Fitriana, (2024) *Six Sigma* and *data mining* in the coal industry, good data management can help companies identify the causes of quality mismatches and improve the efficiency of operational processes in an ongoing manner.

In addition, the development of digital transformation in operations encourages companies to utilize information systems and data analysis to maintain operational sustainability. Explains that Big Data Analytics capabilities have a positive influence on Stuttgart et al, (2024) *sustainable performance* because they help organizations make faster, more accurate, and more efficient decisions. The use of an integrated information system allows companies to monitor data quality in real time so that the potential for input errors, data inconsistencies, and information delays can be minimized.

The implementation of continuous operation management is also related to continuous improvement through this approach, the company does not only focus on the final production results, but on the efficiency of the process and the reliability of the information used during operational activities. Research conducted by Kurniawan & Hartini , (2025) *green supply chain management* shows that sustainable operational management can increase efficiency, reduce operational risks, and strengthen the company's competitiveness in the long term. So that good data quality is one of the main

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supporting factors in creating efficient, sustainable, and consistent operations that are able to meet customer needs.

RESEARCH METHODS

This study uses a descriptive qualitative method as the main approach. This approach was chosen to gain an in-depth understanding of how the data management system implemented by PT. Global Energy coal has an impact on operational effectiveness and the potential for errors in data processing. According to qualitative research, it is a method used to research and understand the meaning that arises from social problems or human behavior, through direct interaction with the subject, not solely through statistical data. This research relies on data collection techniques in the form of direct observation and in-depth interviews with parties involved in the process of managing and using digital data systems in companies. Although PT. Batubara Global Energy has used a digital system, but there is no integration between systems and a lack of optimization in its use, which causes the system to still be prone to input errors, to mismatches of information that can affect the company's operational processes. In line with that, he explained that in qualitative research, understanding of meaning is prioritized rather than generalization. Therefore, researchers play a role as the main instrument in the data collection process, by directly observing the use of digital systems, interacting with the use of systems, and identifying existing obstacles and development potentials. Yin, (2017) Creswell, (2013)

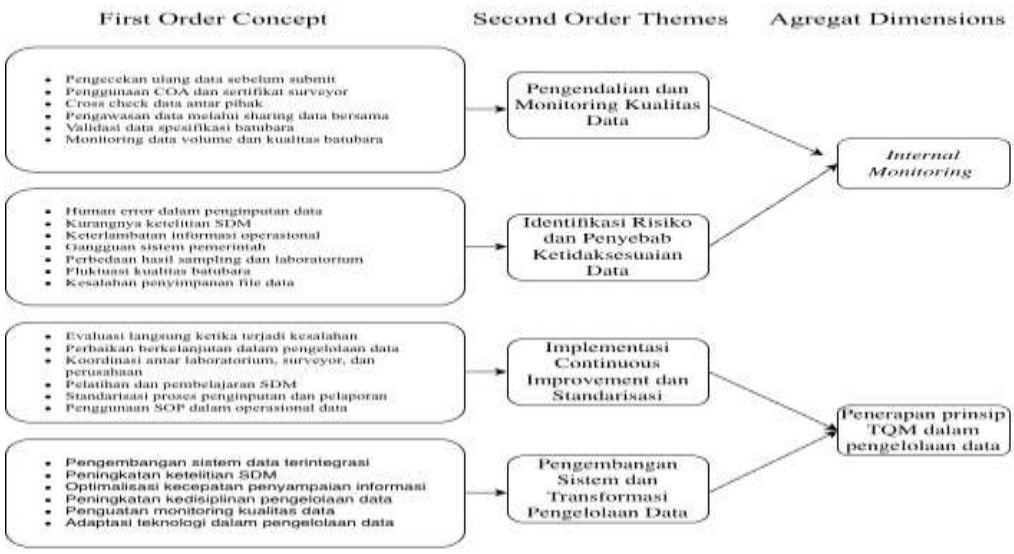
With this approach, it is hoped that the research can provide a comprehensive picture of the challenges and opportunities in optimizing digital data systems in order to support the smooth running of business processes and more accurate decision-making.

RESULTS AND DISCUSSION

Accurate operational data is needed to support the decision-making process, maintain product quality suitability, and minimize misinformation in the company's operational activities. Data inconsistencies can be influenced by various factors such as field conditions, information delays, and lack of accuracy of human resources in the data input and validation process. Therefore, the application of TQM principles is important to help companies improve the accuracy, consistency, and quality control of operational data on an ongoing basis (. The following are the results of interviews conducted with the company's operational staff and supervisors: (Sohrabi et al., 2022) Anil & Satish, 2019a)

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Data Display Images

Thematic Analysis Interview Results

1) The process of controlling the quality of coal specification data at PT Batubara Global Energy

Before operational data is used or submitted, PT Batubara Global Energy conducts verification and re-examination as part of the quality control procedure for coal specification data. To improve the accuracy and maintain the reliability of the data used by the company, supporting documents such as timesheets, COA (Certificate of Analysis), and certificates from independent surveyors are also used. However, based on the findings of the interviews, it is known that inaccuracies in the data input process and possible data mismatches due to the fluctuating nature of coal remain problems in the data control process. To ensure that there are no errors before the final delivery stage, the company implements a cross-checking procedure and direct communication between

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parties if data discrepancies are found. This situation shows that data quality control procedures depend not only on supporting documents, but also on teamwork and dedication of staff in the data verification process. This is in line with the following speakers' responses:

> *"Some supporting documents came out from the ship... We see in the timesheet. We have COA data quality, there is a certificate, and the certificate must be correct because it is issued by an independent surveyor." (J.H, Manager).*

Another source said :

> *"So before the data is submitted, it is usually re-checked first so that the data is correct and according to the laboratory results. If a discrepancy is found, the data will be corrected first before proceeding to the final submission stage." (M.A, Sampling staff)*

PT Batubara Global Energy controls the quality of Batubara specification data through the process of verification, re-checking, and using supporting documents such as *COAs, timesheets*, and certificates from *independent surveyors.* While data input errors and variations in coal quality are still possible, the company addresses these issues by cross-checking and communicating with relevant parties to ensure the data is accurate and reliable before use.

2) Factors that cause inconsistencies in coal volume and specification data at PT Batubara Global Energy

Inconsistencies in coal specification data at PT Batubara Global Energy are caused by external factors that hinder the data management process and operational conditions in the field. Based on the findings of the interview, the operational officer explained that coal data is highly volatile due to the possibility of changes in coal quality during the loading process. Changes in the composition of the coal mixture at the site can affect criteria such as calorific values, thus causing a difference between the initial examination and the actual result when the operation is completed. The operations manager added that delays in corporate data reporting and disruptions to government systems that can hamper administrative procedures and data reporting are additional issues that lead to data mismatches. These conditions indicate that the data

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inconsistencies are influenced by systemic factors and cooperation between parties in the company's operational procedures, in addition to technical reasons related to the volatile nature of the coal commodity. This is in line with the following speakers' responses:

> *"Coal data is indeed very volatile because the quality can change depending on conditions in the field and the loading process. For example, during the initial check, the calorie results are so much, but after the process is completed, the actual results can be slightly different."* (M.F, Operational Staff)

Another source said :

> *"In the operational process, there are usually several obstacles that affect data management, such as delays in submitting company data details and disruptions in government systems. If the government system is disrupted or down, the reporting and administrative processes are also hampered." (J.H, Manager)*

Based on the results of the interview, the discrepancy in coal specification data at PT Batubara Global Energy was caused by fluctuations in coal quality during the operational process, delays in data submission, and system disruptions that hindered the reporting and administration process. These factors cause discrepancies between the initial data and actual conditions so that they require further adjustment and verification.

3) The application of Total Quality Management (TQM) principles can help improve the accuracy, consistency, and documentation of coal specification data

The procedures for continuous re-examination, evaluation, and communication to maintain data quality show the application of the Total Quality Management (TQM) concept in the management of coal specification data at PT Batubara Global Energy. Based on the interview findings, the sampling staff explained that a re-examination was carried out before the data submission to ensure there were no errors in data input, laboratory testing, or sampling procedures. If data discrepancies are found, an evaluation will be carried out so that the root cause of the error can be immediately detected and corrected. To maintain the quality and accuracy of the data used by the company, the operational staff further explained that if there is inappropriate data, the relevant parties will immediately communicate and re-check as soon as possible. This situation

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demonstrates how TQM principles such as quality control, interdepartmental cooperation, and continuous improvement are applied to maintain consistency of operational data and documentation. Businesses can reduce data errors and guarantee that coal specification data is accurate and verifiable through a continuous assessment process and cross-checking procedures. This is in line with the statement of the resource person that,

> *"Before the data is submitted, it will be re-checked, evaluation will be carried out if data differences are found, and confirm whether there are errors during sampling, testing, or data input." (M.A, Staff Sampling)*

Another source said :

> *"It will be checked directly, they will contact us directly, communicated directly so that they can be quickly checked again. So any data that is considered inappropriate will be immediately communicated and checked again so that the data used remains accurate and accountable" (M.F, Operational Staff)*

PT Batubara Global Energy has implemented the principles of Total Quality Management (TQM) through continuous re-checking, evaluation, and communication between parties. The implementation helps maintain the accuracy, consistency, and quality of coal specification data and minimizes errors in the company's operational processes.

DISCUSSION

Using official documents such as Certificates of Analysis (COA), reports from independent surveyors, and ship timesheets as a basis for verifying operational data after the loading process is complete, quality control of coal specification data is carried out based on interviews with supervisors and operational staff. To minimize recording errors and improve the accuracy of operational data, all data is also verified jointly by related parties to ensure the accuracy of coal specifications. This is in line with research by those who state that supporting documentation can improve the reliability of information and reduce data errors. In addition, the research conducted by explains that to ensure the accuracy of the data generated in supporting the company's decision-making, the internal control system requires periodic data verification. Because the use of independent parties can increase the credibility of corporate reporting, the involvement of independent

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surveyors also demonstrates efforts to maintain impartiality and transparency of operational data Asmawati & Widajantie, (2025) Moreira Monteiro et al, (2021) (Kordecki & Grant, 2023)

The results of the interviews show that operational conditions, fluctuations in coal quality in the field, human factors, and limitations in the company's operational system all have an impact on inaccurate data in coal quality management. The difference between the reported data and actual field conditions is caused by weather exposure, transportation delays, stock buildup, and changes in coal conditions during the sampling process. As a result, companies must double-check the data before using it in operational decision-making. High operational activity also increases the likelihood of human error, including conflicting information, reporting delays, and data input errors. These conditions hamper the company's administrative procedures and increase the operational workload. This is in line with research that explains that changes in coal quality are influenced by operational conditions ranging from mining areas to coal piles, research that states that human error is one of the causes of low operational effectiveness in the mining industry, and research that emphasizes the importance of operational supervision and communication between departments to minimize the risk of data inaccuracies in the mining sector. Hardianto et al, (2021) Alfarabi et al, (2024) Zahirah et al, (2024)

Before using data in decision-making, companies use interdepartmental coordination, direct communication, and data validation to assess and re-check if there are discrepancies in operational data based on interview results. To reduce the possibility of data inaccuracies, all operational data is also shared with related parties for cross-checking. To support sustainable operational effectiveness, organizations not only conduct assessments but also seek to improve the quality of data management by strengthening work discipline, improving operational coordination, and accelerating information flow. This condition shows that the principles of Total Quality Management (TQM) are being applied, especially in the field of operational data quality control and continuous improvement. This is in line with research that explains how routine operational evaluations can reduce work errors and improve the quality of operational processes, research that states that the implementation of TQM can improve the effectiveness of operational control through continuous evaluation and improvement, and research that confirms that the operational effectiveness of a company is influenced by communication, accuracy of information, and continuous operational supervision. Psomas & Antony, (2017) Anil & Satish, (2019b) Zahirah et al, (2024)

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CONCLUSION

This study aims to analyze the process of quality control of coal specification data at PT Batubara Global Energy, identify the factors that cause data mismatches, and analyze the application of Total Quality Management (TQM) principles in improving the accuracy, consistency, and documentation of coal specification data. Based on the results of observations, interviews, and discussions that have been carried out, it can be concluded that:

PT Batubara Global Energy has implemented a process of quality control of coal specification data through verification, validation, and re-checking of data before it is used or submitted to related parties. The process is supported by the use of supporting documents such as Certificate of Analysis (COA), timesheets, and certificates from independent surveyors to ensure that the data used is in accordance with actual conditions and laboratory test results. In addition, the company also implements cross-checking and communication between parties if data discrepancies are found.

The discrepancy in coal specification data at PT Batubara Global Energy is influenced by several factors, namely fluctuations in coal quality during the operational process, potential data input errors, delays in information delivery, and interference in external systems used in the administration and reporting process. These factors cause differences between the initial data and actual conditions, requiring further verification and adjustment processes before the data is used in operational or export activities.

The application of Total Quality Management (TQM) principles, especially process focus, employee involvement, and supplier quality, helps companies maintain the quality of coal specification data. This is shown through the implementation of continuous evaluation, data re-checking, communication between parties involved, and cooperation with laboratories and independent surveyors to ensure the accuracy of the data. The application of these principles contributes to improving the accuracy, consistency, and quality of operational data documentation so that it can support the smooth running of the company's business processes.

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